Elizabeth Comfort
Finance Director

Department of Finance
Public Services Building
2051 Kaen Road, Suite 490 | Oregon City, OR 97045

November 8, 2023 BCC Agenda Date/Item: _____

Board of County Commissioners
Clackamas County

Approval of a Public Improvement Contract with Hydro-Temp Mechanical, Inc. for the Central Utility Plant Expansion Equipment Installation Project. Contract value is $1,194,000. Funding is through budgeted County General Funds and is eligible for 50% reimbursement from the Oregon Courthouse Capital Construction and Improvement Fund.

Previous Board Action/Review	Briefed at Issues November 7, 2023		
Performance Clackamas	Build (maintain) a strong infrastructure. Ensure a safe, healthy and secure communities.		
Counsel Review	Yes	**Procurement Review**	Yes
Contact Person	Paul Landaas	**Contact Phone**	503-557-6420

EXECUTIVE SUMMARY: Aligning with the Red Soils Master Plan the Central Utility Plant (CUP) is in need of completing the full build-out that was part of the original design in 2007. This build-out is in support of the construction of the New Courthouse. Due to the extended lead times for product procurement, we have purchased the major components necessary in order to get them on order. This contract is now for installation of the equipment purchased.

This request for bid was advertised in accordance with ORS and LCRB Rules on 07/20/2023. The Bid process closed on 08/17/2023 with 2 bids. The bids came in as follows:

Johnson Controls - $1,401,982.00
Hydro-Temp Mech - $1,194,000.00

RECOMMENDATION: Staff respectfully recommends that the Board approve and sign this contract for the installation of the equipment that the County has purchased in support of the new Courthouse project.

Respectfully submitted,

Elizabeth Comfort

Elizabeth Comfort
Director Finance

For Filing Use Only

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT
Contract #8530

This Public Improvement Contract (the "Contract"), is made by and between the Clackamas County, a political subdivision of the State of Oregon ("Owner"), and **Hydro-Temp Mechanical, Inc.,** (the "Contractor"), both collectively the "Parties". This Contract shall become effective on the date this Contract has been signed by all the Parties and shall expire upon completion the completion of all obligations under the terms of this Contract unless terminated earlier by the Parties.

All capitalized terms in this Contract shall have the meanings identified in the Clackamas County General Conditions for Public Improvement Contracts (10/13/2021) ("General Conditions") referenced within the Instructions to Bidders.

Project Name: **BID#2023-61 CUP Expansion Equipment Installation Project**

1. Contract Price, Contract Documents and Work.
The Contractor hereby agrees to perform all Work described in, and reasonably inferred from, the Contract Documents. In consideration of the Contractor performing the Work in accordance with the terms of the Contract, the Owner agrees to pay the Contractor the sum of **One Million One Hundred Ninety Four Thousand Dollars ($1,194,000.00)** (the "Contract Price"). Payment will be made in accordance with the terms and conditions provided in the Contract Documents. The Contract Price is the amount contemplated by the Base Bid, as indicated in the accepted Bid.

The following documents are incorporated by reference in this Contract and made a part hereof:

- Notice of Contract Opportunity
- Supplemental Instructions to Bidders
- Bid Form
- Clackamas County General Conditions
- Prevailing Wage Rates
- Plans, Specifications and Drawings
- Instructions to Bidders
- Bid Bond
- Performance Bond and Payment Bond
- Supplemental General Conditions
- Payroll and Certified Statement Form

2. Representatives.
Contractor has named Zach Rich as its Authorized Representative to act on its behalf. Owner designates, or shall designate, its Authorized Representative as indicted below (check one):

☒ Unless otherwise specified in the Contract Documents, the Owner designates Paul Landaas as its Authorized Representative in the administration of this Contract. The above-named individual shall be the initial point of contact for matters related to Contract performance, payment, authorization, and to carry out the responsibilities of the Owner.

☐ Name of Owner's Authorized Representative shall be submitted by Owner in a separate writing.

3. Key Persons.
The Contractor's personnel identified below shall be considered Key Persons and shall not be replaced during the project without the written permission of Owner, which shall not be unreasonably withheld. If the Contractor intends to substitute personnel, a request must be given to Owner at least 30 days prior to the intended time of substitution. When replacements have been approved by Owner, the Contractor shall provide a transition period of at least 10 working days during which the original and replacement personnel shall be

working on the project concurrently. Once a replacement for any of these staff members is authorized, further replacement shall not occur without the written permission of Owner. The Contractor's project staff shall consist of the following personnel:

Project Executive: Stephanie Carkin shall be the Contractor's project executive, and will provide oversight and guidance throughout the project term.

Project Manager: Zach Rich shall be the Contractor's project manager and will participate in all meetings throughout the project term.

Job Superintendent: Brent Charbonneau shall be the Contractor's on-site job superintendent throughout the project term.

Project Engineer: Dylan Duckworth shall be the Contractor's project engineer, providing assistance to the project manager, and subcontractor and supplier coordination throughout the project term.

4. Contract Dates.
The Contractor agrees to complete the Work in accordance with the following key dates:

COMMENCEMENT DATE: Upon Issuance of Notice to Proceed
SUBSTANTIAL COMPLETION DATE: March 31, 2024
FINAL COMPLETION DATE: June 30, 2024

Time is of the essence for this Contract. It is imperative that the Work in this Contract reach Substantial Completion and Final Completion by the above specified dates.

5. Insurance Certificates.
In accordance with Section G.3.5 of the General Conditions, Contractor shall furnish proof of the required insurance naming Clackamas County as an additional insured. Insurance certificates may be returned with the signed Contract or may be emailed to the County Contract Analyst.

6. Tax Compliance.
The Contractor shall comply with all federal, state and local laws, regulation, executive orders and ordinances applicable to this Contract. Contractor represents and warrants that it has complied, and will continue to comply throughout the duration of this Contract and any extensions, with all tax laws of this state or any political subdivision of this state, including but not limited to ORS 305.620 and ORS chapters 316, 317, and 318. Any violation of this section shall constitute a material breach of this Contract and shall entitle County to terminate this Contract, to pursue and recover any and all damages that arise from the breach and the termination of this Contract, and to pursue any or all of the remedies available under this Contract or applicable law.

7. Confidential Information.
Contractor acknowledges that it and its employees or agents may, in the course of performing their responsibilities under this Contract, be exposed to or acquire information that is confidential to Owner. Any and all information of any form obtained by Contractor or its employees or agents in the performance of this Contract shall be deemed confidential information of Owner ("Confidential Information"). Contractor agrees to hold Confidential Information in strict confidence, using at least the same degree of care that Contractor uses in maintaining the confidentiality of its own confidential information, and not to copy, reproduce, sell, assign, license, market, transfer or otherwise dispose of, give, or disclose Confidential Information to third

parties or use Confidential Information for any purpose unless specifically authorized in writing under this Contract.

8. Counterparts.
This Contract may be executed in several counterparts, all of which when taken together shall constitute an agreement binding on all Parties, notwithstanding that all Parties are not signatories to the same counterpart. Each copy of the Contract so executed shall constitute an original.

9. Integration.
All provisions of state law required to be part of this Contract, whether listed in the General or Special Conditions or otherwise, are hereby integrated and adopted herein. Contractor acknowledges the obligations thereunder and that failure to comply with such terms is a material breach of this Contract.

The Contract Documents constitute the entire agreement between the parties. There are no other understandings, agreements or representations, oral or written, not specified herein regarding this Contract. Contractor, by the signature below of its authorized representative, hereby acknowledges that it has read this Contract, understands it, and agrees to be bound by its terms and conditions.

10. Compliance with Applicable Law. Contractor shall comply with all federal, state, county, and local laws, ordinances, and regulations applicable to the Work to be done under this Contract including, but not limited to, compliance with the prohibitions set forth in ORS 652.220, compliance of which is a material element of this Contract and failure to comply is a material breach that entitles County to exercise any rights and remedies available under this Contract including, but not limited to, termination for default.

11. Responsibility for Taxes. Contractor is solely responsible for payment of any federal, state, or local taxes required as a result of the Contract or the Work including, but not limited, to payment of the corporate activity tax imposed under enrolled HB 3427 (2019 Oregon regular legislative session). Contractor may not include its federal, state, or local tax obligations as part of the cost to perform the Work.

In witness whereof, Owner executes this Contract and the Contractor does execute the same as of the day and year first above written.

Contractor DATA:
Hydro-Temp Mechanical, Inc.
28465 SW Boberg Road
Wilsonville, Oregon 97070

Contractor CCB # 63907 Expiration Date: 1/25/2024
Oregon Business Registry # 210517-19 Entity Type: DBC State of Formation: Oregon

SIGNATURE PAGE FOLLOWS

Payment information will be reported to the IRS under the name and taxpayer ID# provided by the Contractor. Information must be provided prior to contract approval. Information not matching IRS records could subject Contractor to 28 percent backup withholding.

Hydro-Temp Mechanical, Inc.	Clackamas County
9/7/23	
Authorized Signature Date	Chair Date
Stephanie Carkin / V. President	
Name / Title Printed	Recording Secretary
	APPROVED AS TO FORM
	10/16/2023
	County Counsel Date

RECEIVED

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT OPPORTUNITY

Table of Contents

CLACKAMAS COUNTY
NOTICE OF PUBLIC IMPROVEMENT CONTRACT OPPORTUNITY

INVITATION TO BID #2023-61
CUP Expansion Equipment Installation Project
July 20, 2023

Clackamas County ("County") through its Board of County Commissioners is accepting sealed bids for the **CUP Expansion Equipment Installation Project** until **August 17, 2023, 2:00 PM,** Pacific Time, ("Bid Closing") at the following location:

Bidding Documents can be downloaded from the state of Oregon procurement website ("OregonBuys") at the following address: https://oregonbuys.gov/bso/view/login/login.xhtml, Document No.S-C01010-000007584.
Prospective Bidders will need to sign in to download the information and that information will be accumulated for a Plan Holder's List. Prospective Bidders are responsible for obtaining any Addenda from Website listed above.

Submitting Proposals: Bid Locker
Proposals will only be accepted electronically thru a secure online bid submission service, **Bid Locker**.
Email submissions to Clackamas County email addresses will no longer be accepted.

A. Completed proposal documents must arrive electronically via Bid Locker located at https://bidlocker.us/a/clackamascounty/BidLocker.
B. Bid Locker will electronically document the date and time of all submissions. Completed documents must arrive by the deadline indicated in Section 1 or as modified by Addendum. LATE PROPOSALS WILL NOT BE ACCEPTED.
C. Proposers must register and create a profile for their business with Bid Locker in order to submit for this project. It is free to register for Bid Locker.
D. Proposers with further questions concerning Bid Locker may review the Vendor's Guide located at https://www.clackamas.us/how-to-bid-on-county-projects .

Contact Information
Procurement Process and Technical Questions: Tralee Whitley at TWhitley@clackamas.us

A **Mandatory Pre-Bid Conference** will be conducted on **August 3**, **2023 at 10:00 AM**. Bidders shall meet with County representatives at the **site location** located at **1710 Red Soils Ct, Suite #200, Oregon City** for that purpose. Attendance will be documented through a sign-in sheet prepared by the County representative. Prime bidders who arrive more than ten (10) minutes after the start time of the meeting (as stated in the solicitation and by the County's watch) or after the discussion portion of the meeting (whichever comes first) shall not be permitted to sign in and will not be permitted to submit a bid on the project.

Bids will be opened and publicly read aloud at the above Delivery address after the Bid Closing. Bid results will also be posted to the OregonBuys listing shortly after the opening.

Prevailing Wage
Prevailing Wage Rates requirements apply to this Project because the maximum compensation for all Owner-contracted Work is more than $50,000. Contractor and all subcontractors shall comply with the provisions of ORS 279C.800 through 279C.870, relative to Prevailing Wage Rates. The Bureau of Labor and Industries (BOLI) wage rates and requirements set forth in the following BOLI booklet (and any

listed amendments to that booklet), which are incorporated herein by reference, apply to the Work authorized under this Agreement:

PREVAILING WAGE RATES for Public Works Contracts in Oregon, July 5, 2023, which can be downloaded at the following web address: http://www.oregon.gov/boli/WHD/PWR/Pages/pwr_state.aspx The Work will take place in Clackamas County, Oregon.

Clackamas County encourages bids from Minority, Women, and Emerging Small Businesses.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

INSTRUCTIONS TO BIDDERS

Clackamas County Local Contract Review Board Rules ("LCRB Rules") govern this procurement process. LCRB Rules may be found at: http://www.clackamas.us/code/documents/appendixc.pdf. The Instructions to Bidders is applicable to the procurement process for Clackamas County, or any component unit thereof identified on the Notice of Public Improvement Contract Opportunity, herein after referred to as the "Owner."

Article 1. Scope of Work

The work contemplated under this contract with the Owner, includes all labor, materials, transportation, equipment and services necessary for, and reasonably incidental to, the completion of all construction work in connection with the project described in the Project Manual which includes, but is not necessarily limited to, the Notice of Public Improvement Contract Opportunity, Instructions to Bidders, Supplemental Instructions to Bidders, Bid Form, Bid Bond, Public Improvement Contract Form, Performance Bond, Payment Bond, Clackamas County General Conditions for Public Improvement Contracts (10/13/2021), Supplemental General Conditions, and Plans, Specifications and Drawings.

Article 2. Examination of Site and Conditions

Before making a Bid, the Bidder shall examine the site of the work and ascertain all the physical conditions in relation thereto. The Bidder shall also make a careful examination of the Project Manual including the plans, specifications, and drawings and other contract documents, and shall be fully informed as to the quality and quantity of materials and the sources of supply of the materials. Failure to take these steps will not release the successful Bidder from entering into the contract nor excuse the Bidder from performing the work in strict accordance with the terms of the contract at the price established by the Bid.

The Owner will not be responsible for any loss or for any unanticipated costs, which may be suffered by the successful Bidder, as a result of such Bidder's failure to be fully informed in advance with regard to all conditions pertaining to the work and the character of the work required, including site conditions. No statement made by an elected official, officer, agent, or employee of the Owner in relation to the physical or other conditions pertaining to the site of the work will be binding on the Owner, unless covered by the Project Manual or an Addendum.

Article 3. Interpretation of Project Manual and Approval of Materials Equal to Those Provided in the Specifications

If any Bidder contemplating submitting a Bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications or forms of contract documents, or detects discrepancies or omissions, such Bidder may submit to the Architect (read "Engineer" throughout in lieu of Architect as appropriate) a written request for an interpretation thereof at least ten (10) calendar days prior to the date set for the Bid Closing.

When a prospective Bidder seeks approval of a particular manufacturer's material, process or item of equal value, utility or merit other than that designated by the Architect in the Project Manual, the Bidder may submit to the Architect a written request for approval of such substitute at least ten (10) calendar days prior to the date set for the Bid Closing. The prospective Bidder submitting the request will be responsible for its prompt delivery.

Requests of approval for a substitution from that specified shall be accompanied by samples, records of performance, certified copies of tests by

impartial and recognized laboratories, and such other information as the Architect may request.

To establish a basis of quality, certain processes, types of machinery and equipment or kinds of materials may be specified in the Project Manual either by description of process or by designating a manufacturer by name and referring to a brand or product designation or by specifying a kind of material. Whenever a process is designated or a manufacturer's name, brand or item designation is given, or whenever a process or material covered by patent is designated or described, it shall be understood that the words "or approved equal" follow such name, designation or description, whether in fact they do so or not.

Any interpretation of the Project Manual or approval of manufacturer's material will be made only by an Addendum duly issued. All Addenda will be posted to the OregonBuys listing and will become a part of the Project Manual. The Owner will not be responsible for any other explanation or interpretation of the Project Manual nor for any other approval of a particular manufacturer's process or item for any Bidder.

When the Architect approves a substitution by Addendum, it is with the understanding that the Contractor guarantees the substituted article or material to be equal or better than the one specified.

Article 4. Security to Be Furnished by Each Bidder

Each Bid must be accompanied by either 1) a cashier's check or a certified check drawn on a bank authorized to do business in the State of Oregon, or 2) a Bid bond described hereinafter, executed in favor of the Owner, for an amount equal to ten percent (10%) of the total amount Bid as a guarantee that, if awarded the contract, the Bidder will execute the contract and provide a performance bond and payment bond as required. The successful Bidder's check or Bid bond will be retained until the Bidder has entered into a contract satisfactory to Owner and furnished a one hundred percent (100%) performance bond and one hundred percent (100%) payment bond. The Owner reserves the right to hold the Bid security as described in Article 10 hereof. Should the successful Bidder fail to execute and deliver the contract as provided for in Article 12 hereof, including a satisfactory performance bond and payment bond within twenty (20) calendar days after the Bid has been accepted by the Owner, then the contract award made to such Bidder may be considered canceled and the Bid security may be forfeited as liquidated damages at the option of the Owner. The date of the acceptance of the Bid and the award of the contract as contemplated by the Project Manual shall mean the date of acceptance specified in the Notice of Intent to Award.

Article 5.Execution of Bid Bond

Should the Bidder elect to utilize a Bid bond as described in Article 4 in order to satisfy the Bid security requirements, such form must be completed in the following manner:

A. Bid bonds must be executed on the County forms, which will be provided to all prospective Bidders by the Owner.

B. The Bid bond shall be executed on behalf of a bonding company licensed to do business in the State of Oregon.

C. In the case of a sole individual, the bond need only be executed as principal by the sole individual. In the case of a partnership, the bond must be executed by at least one of the partners. In the case of a corporation, the bond must be executed by stating the official name of the corporation under which is placed the signature of an officer authorized to sign on behalf of the corporation followed by such person's official capacity, such as president, etc. The corporation seal should then be affixed to the bond.

D. The name of the surety must be stated in the execution over the signature of its duly authorized attorney-in-fact and accompanied by the seal of the surety corporation.

Article 6. Execution of the Bid Form

Each Bid shall be made in accordance with: (i) the sample Bid Form accompanying these instructions; (ii) the appropriate signatures for a sole individual, partnership, corporation or limited liability corporation shall be added as noted in Article 5C above; (iii) numbers pertaining to base Bids shall be stated both in writing and in figures; and (iv) the Bidder's address shall be typed or printed.

The Bid Form relates to Bids on a specific Project Manual. Only the amounts and information asked for on the Bid Form furnished will be considered as the Bid. Each Bidder shall Bid upon the work exactly as specified and provided in the Bid Form. The Bidder shall include in the Bid a sum to cover the cost of all items contemplated by the Contract. The Bidder shall Bid upon all alternates that may be indicated on the Bid Form. When Bidding on an alternate for which there is no charge, the Bidder shall write the words "No Charge" in the space provided on the Bid Form. If one or more alternates are shown on the Bid Form, the Bidder shall indicate whether each is "add" or "deduct."

Article 7. Prohibition of Alterations to Bid

Bids that are incomplete, or contain ambiguities or have differing conditions required by the Bidder, including requested changes or exceptions to the Public Improvement Contract form or other portions of the Project Manual, may be rejected in Owner's sole and absolute discretion.

Article 8. Submission of Bid

Each Bid shall be sealed in an envelope, properly addressed to the Owner, showing on the outside of the envelope the name of the Bidder and the name of the project. Bids will be received at the time and place stated in the Notice of Public Improvement Contract Opportunity.

Article 9. Bid Closing and Opening of Bids

All Bids must be received by the Owner at the place and time set for the Bid Closing. Any Bids received after the scheduled Bid Closing time for receipt of Bids will be rejected.

At the time of opening and reading of Bids, each Bid received will be publicly opened and read aloud, irrespective of any irregularities or informalities in such Bids.

Generally, Bid results will be posted to the OregonBuys Website within a couple hours of the opening.

Article 10. Acceptance or Rejection of Bids by Owner

Unless all Bids are rejected, the Owner will award a contract based on the lowest responsive Bid from a responsible Bidder. If that Bidder does not execute the contract, it will be awarded to the next lowest responsible Bidder or Bidders in succession.

The Owner reserves the right to reject all Bids and to waive minor informalities. The procedures for contract awards shall be in compliance with the provisions of the LCRB Rules in effect at that time.

The Owner reserves the right to hold the Bid and Bid security of the three lowest Bidders for a period of thirty (30) calendar days from and after the time of Bid opening pending award of the contract. Following award of the contract the Bid security of the three lowest Bidders may be held twenty (20) calendar days pending execution of the contract. All other Bids will be rejected and Bid security will be returned.

In determining the lowest Bidder, the Owner reserves the right to take into consideration any or all authorized base Bids as well as alternates or combinations indicated in the Bid Form.

If no Bid has been accepted within thirty (30) calendar days after the opening of the Bids, each of the three lowest Bidders may withdraw the Bid submitted and request the return of the Bid security.

Article 11. Withdrawal of Bid

At any time prior to the Bid Closing, a Bidder may withdraw its Bid. This will not preclude the

submission of another Bid by such Bidder prior to the time set for the Bid Closing.

After the time set for the Bid Closing, no Bidder will be permitted to withdraw its Bid within the time frames specified in Article 10 for award and execution, except as provided for in that Article.

Article 12. Execution of Contract, Performance Bond and Payment Bond

The Owner will provide the successful Bidder with contract forms within seven (7) calendar days after the completion of the award protest period. The Bidder is required to execute the contract forms as provided, including a performance bond and a payment bond from a surety company licensed to do surety business in the State of Oregon, within seven (7) calendar days after receipt of the contract forms. The contract forms shall be delivered to the Owner in the number called for and to the location as instructed by the Owner.

Article 13. Recyclable Products

Contractors will use recyclable products to the maximum extent economically feasible in the performance of the Contract.

Article 14. Clarification or Protest of the Solicitation Document or Specifications

Any request for clarification or protest of the solicitation document or specifications must be submitted in the manner provided for in the applicable section of the LCRB Rules to the Procurement Representative referenced in the Notice of Public Improvement Contract Opportunity.

A protest of the Solicitation Document must be received within seven (7) business days of the issuance of the Bid or within three (3) business days of issuance of an addendum.

Requests for clarification may be submitted no less than five (5) business days prior to the Bid Closing Date.

Article 15. Protest of Intent to Award

Owner will name the apparent successful Bidder in a "Notice of Intent to Award" letter. Identification of the apparent successful Bidder is procedural only and creates no right in the named Bidder to the award of the contract. Competing Bidders will be notified by publication of the Notice of Intent to Award on the OregonBuys Website of the selection of the apparent successful Bidder(s) and Bidders shall be given seven (7) calendar days from the date on the "Notice of Intent to Award" letter to review the file at the Procurement Division office and file a written protest of award, pursuant to C-049-0450. Any award protest must be in writing and must be delivered by email, hand delivery, or mail to the Procurement Division Director at: Procurement Division, 2051 Kaen Road, Oregon City, OR 97045.

Article 16. Disclosure of First-Tier Subcontractors

Within two (2) working hours after the Bid Closing, all Bidders shall submit to the County a disclosure form identifying any first-tier subcontractors (those entities that would be contracting directly with the prime contractor) that will be furnishing labor and materials on the contract, if awarded, whose subcontract value would be equal to or greater than: (a) Five percent (5%) of the total contract price, but at least $15,000; or (b) $350,000, regardless of the percentage of the total contract price.

Disclosures may be submitted with the Bid or may be hand delivered to the Bid Closing address or emailed to the Contract Information Analyst listed on the Notice of Contract Opportunity.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

Project Name #2023-61 CUP Expansion Equipment Installation Project

The following modify the Clackamas County "Instructions to Bidders" for this Project. Where a portion of the Instructions to Bidders has been modified by these Supplemental Instructions to Bidders, the unaltered portions shall remain in effect.

1. **Mandatory Pre-Bid Conference** will be conducted on **August 3**, **2023 at 10:00 AM**. Bidders shall meet with County representatives at the **site location** located at **1710 Red Soils Ct, Suite #200, Oregon City** for that purpose. Attendance will be documented through a sign-in sheet prepared by the County representative. Prime bidders who arrive more than ten (10) minutes after the start time of the meeting (as stated in the solicitation and by the County's watch) or after the discussion portion of the meeting (whichever comes first) shall not be permitted to sign in and will not be permitted to submit a bid on the project.

2. **Electronic Submissions:** The County is requiring all bids for this project be electronically submitted. Complete Bids (including all attachments) will only be accepted electronically thru a secure online bid submission service, Bid Locker. Email submissions to Clackamas County email addresses will no longer be accepted. https://bidlocker.us/a/clackamascounty/BidLocker.

Bids will be publicly read aloud via the computer application, Zoom. Bidders will be allowed to video conference or listen by phone to the bid results. The projects Zoom meeting can be accessed via the information below:

ZOOM LINKS
Join Zoom Meeting
https://clackamascounty.zoom.us/j/83845726435

Meeting ID: 838 4572 6435

One tap mobile
+16699006833,,83845726435# US (San Jose) 17193594580,,83845726435# US

Dial by your location
• +1 669 900 6833 US (San Jose)
• +1 719 359 4580 US
• +1 253 205 0468 US
• +1 253 215 8782 US (Tacoma)
• +1 346 248 7799 US (Houston)
• +1 408 638 0968 US (San Jose)
• +1 669 444 9171 US
• +1 309 205 3325 US

• +1 312 626 6799 US (Chicago)
• +1 360 209 5623 US
• +1 386 347 5053 US
• +1 507 473 4847 US
• +1 564 217 2000 US
• +1 646 876 9923 US (New York)
• +1 646 931 3860 US
• +1 689 278 1000 US
• +1 301 715 8592 US (Washington DC)
• +1 305 224 1968 US

Meeting ID: 838 4572 6435

Find your local number: https://clackamascounty.zoom.us/u/kmGee3BV2

**The Apparent Low bid results will be posted to the projects OregonBuys listing as soon as possible following the bid opening.

3. **Good Faith Effort:** Clackamas County encourages participation in contracts by Historically Underrepresented Businesses. "Historically Underrepresented Businesses" are State of Oregon-certified and self-identified minority, women and emerging small business as well as firms that are certified federally or by another state or entity with substantially similar requirements as the State of Oregon.

   Bidders must perform Good Faith Effort (defined below) and submit **Form 1 and Form 2** for the Bidders Bid to be considered responsive. **Form 1 and Form 2** must be submitted within **two (2) hours** after the Closing Date and Time. Form 1 and Form 2 may be submitted to either the Contact Information Analyst listed on Notice of Contract Opportunity or via the https://bidlocker.us/a/clackamascounty/BidLocker listing.

   "Good Faith Effort" is a requirement of a prime contractor to reach out to at least three Historically Underrepresented Business Subcontractors for each division of work that will be subcontracted out and to complete the required forms. If fewer than three Historically Underrepresented Business Subcontractors are reasonably available for a particular division of work, the Bidder must specifically note the reason for there being fewer than three contacts. The outreach should be performed with sufficient time to give the subcontractors at least 5 calendar days to respond to the opportunity. Form 3, which documents the actual amount of subcontractors on the project, must be submitted with the project final pay application. Compliance with the Good Faith Effort and submission of Forms 1, 2 and 3 is a contractual requirement for final payment.

   The sufficiency of the documentation or the performance of Good Faith Effort shall be in the sole and absolute determination of Clackamas County. Only those Bidders that Clackamas County has determined have not sufficiently performed Good Faith Effort shall have protest rights of the determination for such Bidder. No Bidder shall have protest rights of the sufficiency of any other Bidder completing Good Faith Effort.

CLACKAMAS COUNTY
GOOD FAITH EFFORT
SUBCONTRACTOR AND SELF-PERFORMED WORK LIST
(FORM 1)

Prime Contractor Name: Total Contract Amount:

Project Name: #2023-61 CUP Expansion Equipment Installation Project

PRIME SELF-PERFORMING: Identify below ALL GFE Divisions of Work (DOW) to be self-performed. Good Faith Efforts are otherwise required.

DOW BIDDER WILL SELF-PERFORM *(GFE not required)*	
Division 23 - Mechanical	

PRIME CONTRACTOR SHALL DISCLOSE AND LIST ALL SUBCONTRACTORS, including those Minority-owned, Woman-owned, and Emerging Small Businesses ("M/W/ESB") that you intend to use on the project. Delivery via bid locker https://bidlocker.us/a/clackamascounty/BidLocker within 2 hours of the BID/Quote Closing Date/Time.

LIST ALL SUBCONTRACTORS BELOW Use correct legal name of Subcontractor (No Assumed Business Names)	Division of Work (Painting, electrical, landscaping, etc.) List ALL DOW performed by Subcontractors	DOLLAR AMOUNT OF SUBCONTRACT	If Certified or self-reporting MBE/WBE/ESB Subcontractor Check box ☑		
			MBE	WBE	ESB
Name Address City/St/Zip Phone# OCCB# none	n/a	n/a	☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐

GFE SUBCONTRACTOR AND SELF-PERFORMED WORK LIST (FORM 1) cont'd

Prime Contractor Name: Hydro-Temp Mechanical Total Contract Amount: $1,194,000.00

LIST ALL SUBCONTRACTORS BELOW Use correct legal name of Subcontractor (No Assumed Business Names)	Division of Work (Painting, electrical, landscaping, etc.) List ALL DOW performed by Subcontractors	DOLLAR AMOUNT OF SUBCONTRACT	If Certified or self-reporting MBE/WBE/ESB Subcontractor Check box		
			MBE	WBE	ESB
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐
Name Address City/St/Zip Phone# OCCB#			☐	☐	☐

CLACKAMAS COUNTY
GOOD FAITH EFFORT
M/W/ESB CONTACT / BIDS RECEIVED LOG
(FORM 2)

Prime Contractor:

Project: #2023-61 CUP Expansion Equipment Installation Project

Prime Contractor must contact or endeavor to contact at least 3 M/W/ESB Subcontractors for each Division of Work. Prime Contractor shall record its contacts with M/W/ESB Subcontractors through use of this log (or equivalent) entering all required information. All columns shall be completed where applicable. Additional forms may be copied if needed.

NAME OF M/W/ESB SUBCONTRACTOR	Divisions of Work (Painting, electrical, landscaping, etc.)	Date Solicitation Letter / Fax Sent	PHONE CONTACT		BID ACTIVITY Check Yes or No			REJECTED BIDS (if bid received & not used)		Notes
			Date of Call	Person Receiving Call	Will Bid	Bid Received	Bid Used	Bid Amount	Reason Not Used (Price, Scope or Other. If Other, explain in Notes>>)	
None	n/a	n/a	n/a	n/a	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	n/a	n/a	
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

BID BOND

Project Name: # 2023-61 CUP Expansion Equipment Installation Project

We, Hydro-Temp Mechanical, Inc., as "Principal,"
(Name of Principal)

and Travelers Casualty and Surety Company of America, an Connecticut Corporation,
(Name of Surety)

authorized to transact Surety business in Oregon, as "Surety," hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns to pay unto Clackamas County ("Obligee") the sum of ($ 10%---)

Ten Percent of the Total Amount Bid--- dollars.

WHEREAS, the condition of the obligation of this bond is that Principal has submitted its proposal or bid to an agency of the Obligee in response to Obligee's procurement document (No.***) for the project identified above which proposal or bid is made a part of this bond by reference, and Principal is required to furnish bid security in an amount equal to ten (10%) percent of the total amount of the bid pursuant to the procurement document.

*** #S-C01010-00007584

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, we have caused this instrument to be executed and sealed by our duly authorized legal representatives this 15th day of August, 2023.

Principal: Hydro-Temp Mechanical, Inc.

By: Stephanie Cruz
Signature

Vice President
Official Capacity

Attest:
Corporation Secretary

Surety: Travelers Casualty and Surety Company of America

By: Attorney-In-Fact

Chloe Lyons
Name

Anchor Insurance & Surety, Inc.
One Centerpointe Drive, Suite 190
Address

Lake Oswego, OR 97035
City State Zip

(503) 224-2500
Phone

(503) 224-9830
Fax

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Chloe Lyons** of **PORTLAND**, **Oregon**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this **15th** day of **August**, **2023**.

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

BID FORM

PROJECT: #2023-61 CUP Expansion Equipment Installation Project
BID CLOSING: August 17, 2023, 2:00 PM, Pacific Time
BID OPENING: August 17, 2023, 2:05 PM, Pacific Time

FROM: Hydro-Temp Mechanical Inc.
Bidder's Name (must be full legal name, not ABN/DBA)

TO: https://bidlocker.us/a/clackamascounty/BidLocker

1. Bidder is (*check one of the following and insert information requested*):

____a. An individual; or

____b. A partnership registered under the laws of the State of _____; or

__X__c. A corporation organized under the laws of the State of ____Oregon_____; or

____d. A limited liability corporation organized under the laws of the State of _____;

and authorized to do business in the State of Oregon hereby proposes to furnish all material and labor and perform all work hereinafter indicated for the above project in strict accordance with the Contract Documents for the Basic Bid as follows:

One Million One Hundred Ninety Four Thousand and 00/100 Dollars ($ 1,194,000)

and the Undersigned agrees to be bound by the following documents:

- Notice of Public Improvement Contract Opportunity
- Instructions to Bidders
- Supplemental Instructions to Bidders
- Bid Bond
- Bid Form
- Public Improvement Contract Form
- Performance Bond and Payment Bond
- Clackamas County General Conditions
- Supplemental General Conditions
- Prevailing Wage Rates
- Payroll and Certified Statement Form
- Plans, Specifications and Drawings

- ADDENDA numbered __1___ through__1___, inclusive *(fill in blanks)*

2. The Undersigned proposes to add to or deduct from the Base Bid indicated above the items of work relating to the following Alternate(s) as designated in the Specifications: **N/A**

3. The Undersigned proposes to add to or deduct from the Base Bid indicated above the items or work relating to the following Unit Price(s) as designated in the Specifications, for which any adjustments in the Contract amount will be made in accordance with Section D of the Clackamas County General Conditions: **provide attached bid schedule with bid.**

4. The work shall be completed within the time stipulated and specified in Contract Documents.

5. Accompanying herewith is Bid Security which is equal to ten percent (10%) of the total amount of the Basic Bid, plus the total sum of all Alternatives (if any).

6. The Undersigned agrees, if awarded the Contract, to execute and deliver to Clackamas County, within twenty (20) calendar days after receiving the Contract forms, a Contract Form, and a satisfactory Performance Bond and Payment Bond each in an amount equal to one hundred percent (100%) of the Contract sum, using forms provided by the Owner. The surety requested to issue the Performance Bond and Payment Bond will be:

Anchor Insurance & Surety, Inc.

(name of surety company - not insurance agency)

The Undersigned hereby authorizes said surety company to disclose any information to the Owner concerning the Undersigned's ability to supply a Performance Bond and Payment Bond each in the amount of the Contract.

7. The Undersigned further agrees that the Bid Security accompanying the Bid is left in escrow with Clackamas County; that the amount thereof is the measure of liquidated damages which the Owner will sustain by the failure of the Undersigned to execute and deliver the above-named Contract Form, Performance Bond and Payment Bond, each as published, and that if the Undersigned defaults in either executing the Contract Form or providing the Performance Bond and Payment Bond within twenty (20) calendar days after receiving the Contract forms, then the Bid Security shall become the property of the Owner at the Owner's option; but if the Bid is not accepted within thirty (30) calendar days of the time set for the opening of the Bids, or if the Undersigned executes and timely delivers said Contract Form, Performance Bond and Payment Bond, the Bid Security shall be returned.

8. The Undersigned certifies that: (i) This Bid has been arrived at independently and is being submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment or services described in the invitation to bid designed to limit independent bidding or competition; and (ii) the contents of the Bid have not been communicated by the Undersigned or its employees or agents to any person not an employee or agent of the Undersigned or its surety on any Bond furnished with the Bid and will not be communicated to such person prior to the official opening of the Bid.

9. The undersigned ☒ **HAS,** ☐ **HAS NOT** (*check one*) paid unemployment or income taxes in Oregon within the past 12 months and ☒ **DOES,** ☐ **DOES NOT** (*check one*) a business address in Oregon. The undersigned acknowledges that, if the selected bidder, that the undersigned will have to pay all applicable taxes and register to do business in the State of Oregon before executing the Contract Form.

10. The Undersigned agrees, if awarded a contract, to comply with the provisions of ORS 279C.800 through 279C.870 pertaining to the payment of the prevailing rates of wage.

11. Contractor's CCB registration number is 63907. As a condition to submitting a bid, a Contractor must be registered with the Oregon Construction Contractors Board in accordance with ORS 701.035 to 701.055, and disclose the registration number. Failure to register and disclose the number will make the bid unresponsive and it will be rejected, unless contrary to federal law.

12. The successful Bidder hereby certifies that all subcontractors who will perform construction work as described in ORS 701.005(2) were registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 at the time the subcontractor(s) made a bid to work under the contract.

13. The successful Bidder hereby certifies that, in compliance with the Worker's Compensation Law of the State of Oregon, its Worker's Compensation Insurance provider is Liberty NW, Policy No. WC4INC008542P05, and that Contractor shall submit Certificates of Insurance as required.

14. Contractor's Key Individuals for this project (supply information as applicable):
Project Executive: Stephanie Carkin, Cell Phone: 503-793-0886,
Project Manager: Zach Rich, Cell Phone: 503-793-8242,
Job Superintendent: Brent Charbonneau, Cell Phone: 971-563-4116,
Project Engineer: Dylan Duckworth, Cell Phone: 971-412-8002.

15. The Undersigned certifies that it has not discriminated against minority, women, or emerging small businesses in obtaining any subcontracts for this project.

16. The Undersigned certifies that it has a drug testing program in accordance with ORS 279C.505.

REMINDER: Bidder must submit the below First-Tier Subcontractor Disclosure Form.

By signature below, Contractor agrees to be bound by this Bid.

NAME OF FIRM Hydro-Temp Mechanical Inc

ADDRESS 28465 SW Boberg Rd

Wilsonville, OR 97070

TELEPHONE NO (503) 793-8242

EMAIL zachr@hydrotempmech.com

SIGNATURE 1) _____
Sole Individual

or 2) _____

Partner

or 3) _____

Authorized Officer or Employee of Corporation

***** *END OF BID* *****

CLACKAMAS COUNTY

CUP Equipment Install BID 2023-61

Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

BID#2023-61

No.	Item	Quantity	Unit of Measure	Unit Price or Lump Sum Price Figures	Total Amount Quantity x Unit Price
1	Mobilization (i.e. Crane etc)	1	Lump Sum		$ 100,000 -
2	Materials	1	Lump Sum		$ 477,000 -
3	Permits	1	Lump Sum		$ 17,000 -
4	Labor	1	Lump Sum		$ 600,000 -
				BID TOTAL	**$** 1,194,000 **-**

Firm Name: Hydro-Temp Mechanical

Print Name: Zach Rich

Authorized Signature:

Date: 8/17/23

FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM
PROJECT: #2023-61

BID OPENING: August 17, 2023, 2:00 PM, Pacific Time

Failure to submit this Form by the disclosure deadline will result in a nonresponsive bid.

INSTRUCTIONS:
This First-Tier Subcontractor Disclosure Form ("Form") must be submitted and received at the location specified in the Notice of Public Improvement Contract Opportunity on the advertised Bid Closing, and within two working hours after the advertised Bid Closing Time.

Proposals will only be accepted electronically thru a secure online bid submission service, **Bid Locker**. *Email submissions to Clackamas County email addresses will no longer be accepted.*

A. Completed proposal documents must arrive electronically via Bid Locker located at https://bidlocker.us/a/clackamascounty/BidLocker.
B. Bid Locker will electronically document the date and time of all submissions. Completed documents must arrive by the deadline indicated in Section 1 or as modified by Addendum. LATE PROPOSALS WILL NOT BE ACCEPTED.
C. Proposers must register and create a profile for their business with Bid Locker in order to submit for this project. It is free to register for Bid Locker.
D. Proposers with further questions concerning Bid Locker may review the Vendor's Guide located at https://www.clackamas.us/how-to-bid-on-county-projects .

Subcontractor lists may be submitted with the bid in the same envelope or email at the Bid Closing date and time. Subcontractor lists **MUST** be submitted within **two (2) hours** of the Bid Closing date and time.

List below the name of each subcontractor that will be furnishing labor, or labor and materials, for which disclosure is required, the category of work that the subcontractor will be performing, and the dollar value of the subcontract. Enter **"NONE"** if the value of the project bid is less than $100,000 or there are no subcontractors that need to be disclosed. ATTACH ADDITIONAL SHEETS IF NECESSARY.

	SUBCONTRACTOR NAME	DOLLAR VALUE	CATEGORY OF WORK
1.	NONE	n/a	n/a
2.			
3.			
4.			
5.			
6.			

The above listed first-tier subcontractor(s) are providing labor, or labor and material, with a Dollar Value equal to or greater than:

a) 5% of the total Contract Price, but at least $15,000. If the Dollar Value is less than $15,000 do not list the subcontractor above; or
b) $350,000 regardless of the percentage of the total Contract Price.

Firm Name: Hydro-Temp Mechanical

Bidder Signature: _____ Phone # 503-582-8525

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT
SUPPLEMENTAL GENERAL CONDITIONS

PROJECT: #2023-61

The following modifies the October 13, 2021 Clackamas County General Conditions for Public Improvement Contracts ("County General Conditions") for this Contract. Except as modified below, all other terms and conditions of the County General Conditions shall remain in effect.

1. Good Faith Effort

As a condition of Contractor being awarded a Contract for this Project, Contractor must complete Good Faith Effort outreach and documentation as described in the Supplemental Instructions to Bidders of the Solicitation Document.

The Contractor may not change who is performing each Division of Work identified in Form 1 of the Good Faith Effort without the express written advance approval of Owner. This includes substituting identified subcontractors, self-performance of a Division of Work that was identified to be performed by a subcontractor, or the Contractor subcontracting a Division of Work that was identified to be self-performed by the Contractor.

Contractor shall be required to submit the completed Form 3 with its final pay application as a condition of final payment.

CLACKAMAS COUNTY GENERAL CONDITIONS FOR PUBLIC IMPROVEMENT CONTRACTS
October 13, 2021

INSTRUCTIONS: The attached **Clackamas County General Conditions for Public Improvement Contracts ("County General Conditions")** apply to all designated Public Improvement contracts. Changes to the County General Conditions (including any additions, deletions or substitutions) should only be made by attaching Public Improvement Supplemental General Conditions. The text of these County General Conditions should not otherwise be altered.

TABLE OF SECTIONS

CLACKAMAS COUNTY GENERAL CONDITIONS FOR PUBLIC IMPROVEMENT CONTRACTS ("County General Conditions")

SECTION A
GENERAL PROVISIONS

A.1 DEFINITION OF TERMS

In the Contract Documents the following terms shall be as defined below:

APPLICABLE LAWS, means all federal, state and local laws, codes, rules, regulations and ordinances, as amended applicable to the Work, to the Contract, or to the parties individually.

APPROVED BY CONTRACTING AGENCY, for purposes of ORS 279C.570(2), means the date a progress payment is approved by the Clackamas County Treasurer's office.

ARCHITECT/ENGINEER, means the Person appointed by the Owner to make drawings and specifications and, to provide contract administration of the Work contemplated by the Contract to the extent provided herein or by supplemental instruction of Owner (under which Owner may delegate responsibilities to the Architect/Engineer), in accordance with ORS Chapter 671 (Architects) or ORS Chapter 672 (Engineers) and administrative rules adopted thereunder.

AVOIDABLE DELAYS, mean any delays other than Unavoidable Delays, and include delays that otherwise would be considered Unavoidable Delays but that: (a) Could have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its Subcontractors; (b) Affect only a portion of the Work and do not necessarily prevent or delay the prosecution of other parts of the Work nor the completion of the whole Work within the Contract Time; (c) Do not impact activities on the accepted critical path schedule; and (d) Are associated with the reasonable interference of other contractors employed by the Owner that do not necessarily prevent the completion of the whole Work within the Contract Time.

BIDDER, means a bidder in connection with Instructions to Bidders or a proposer in connection with a Request for Proposals, or Solicitation Document. May also be referenced as "Offeror," "Quoter" or "Proposer" based on the type of Solicitation Document.

CHANGE ORDER, means a written order which, when fully executed by the Parties to the Contract, constitutes a change to the Contract Documents. Change Orders shall be issued in accordance with the changes provisions in Section D and, if applicable, establish a Contract Price or Contract Time adjustment. A Change Order shall not be effective until executed by both parties.

CLAIM, means a demand by Contractor pursuant to Section D.3 for review of the denial of Contractor's initial request for an adjustment of Contract terms, payment of money, extension of Contract Time or other relief, submitted in accordance with the requirements and within the time limits established for review of Claims in these County General Conditions.

CONTRACT, means the written agreement between the Owner and the Contractor comprised of the Contract Documents which describe the Work to be done and the obligations between the parties.

CONTRACT DOCUMENTS, means the Contract, County General Conditions, Supplemental General Conditions if any, Plans, Specifications, the accepted Offer, Solicitation Document and addenda thereto, Instructions to Offerors, and Supplemental Instructions to Offerors.

CONTRACT PERIOD, as set forth in the Contract Documents, means the total period of time beginning with the full execution of a Contract and, if applicable, the issuance of a Notice to Proceed and concluding upon Final Completion.

CONTRACT PRICE, means the total price reflected in the Contract.

CONTRACT TIME, means any incremental period of time allowed under the Contract to complete any portion of the Work as reflected in the Project schedule.

CONTRACTOR, means the Person awarded the Contract for the Work contemplated.

DAYS, are calendar days, including weekdays, weekends and holidays, unless otherwise specified.

DEFECTIVE WORK, means Work that is not completed in accordance with the Specifications or the requirements of the Contract.

DIRECT COSTS, means, unless otherwise provided in the Contract Documents: the cost of materials, including sales tax and the cost of delivery; cost of labor which shall only include the applicable prevailing wage and fringe benefit (if applicable, and if paid to or on behalf of the employee) rate plus a maximum of a twelve percent (12%) markup on the prevailing wage (but not the fringe benefit) to cover Contractor's labor burden including but not limited to social security, Medicare, unemployment insurance, workers' compensation insurance, sick leave pay; substantiated Project cost increases for specific insurance (including, without limitation, Builder's Risk Insurance and Builder's Risk Installation Floater) or bond premiums; rental cost of equipment, and machinery required for execution of the Work; and the additional costs of field personnel directly attributable to the Work; travel expense reimbursement only if specifically authorized and only to the extent allowable under the County Contractor Travel Reimbursement Policy, hereby incorporated by reference.

FINAL COMPLETION, means the final completion of all requirements under the Contract, including Contract Closeout as described in Section K but excluding Warranty Work as described in Section I.2, and the final payment and release of all retainage, if any.

FORCE MAJEURE, means an act, event or occurrence caused by fire, riot, war, acts of God, terrorism, nature, sovereign, or public enemy, strikes, freight embargoes or any other act, event or occurrence that is beyond the control of the party to the Contract who is asserting Force Majeure.

NOTICE TO PROCEED, means the official written notice from the Owner stating that the Contractor is to proceed with the Work defined in the Contract Documents.

OFFER, means a bid in connection with Instructions to Bidders or a proposal in connection with a Request for Proposals, or Solicitation Document to do the work stated in the Solicitation Document at the price quoted. May also be referenced as "Bid," "Quote," or "Proposal" based on the type of Solicitation Document.

OVERHEAD, means those items which may be included in the Contractor's markup (general and administrative expense and profit) and that shall not be charged as Direct Cost of the Work, including without limitation such Overhead expenses as wages or salary of personnel above the level of foreman (i.e., superintendents and project managers), labor rates and fringe benefits above the applicable prevailing wage and fringe benefit (if applicable, and if paid to or on behalf of the employee), Contractor's labor burden for fringe benefit if paid to the employee, expenses of Contractor's offices and supplies at the Project Site (e.g. job trailer) and at Contractor's principal place of business and including expenses of personnel staffing the Project Site office and Contractor's principal place of business, and Commercial General Liability Insurance and Automobile Liability Insurance.

OWNER, means, Clackamas County or any component unit thereof including Clackamas County Development Agency, Clackamas County Service District No. 1, Surface Water Management Agency of Clackamas County, Tri-City Service District, Water Environment Services, North Clackamas Parks and Recreation District, Clackamas County Extension & 4-H Service District, Library Service District of Clackamas County, Enhanced Law Enforcement District, and Clackamas County Service District No. 5. Owner may elect, by written notice to Contractor, to delegate certain duties to more than one agent, including without limitation, to an Architect/Engineer. However, nothing in these County General Conditions is intended to abrogate the separate design professional responsibilities of Architects under ORS Chapter 671 or of Engineers under ORS Chapter 672.

PERSON, means a natural person or entity doing business as a sole proprietorship, a partnership, a joint venture, a corporation, a limited liability company or partnership, a nonprofit, a trust, or any other entity possessing the legal capacity to contract.

PLANS, means the drawings which show the location, type, dimensions, and details of the Work to be done under the Contract.

PRODUCT DATA, means illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

PROJECT, means the total undertaking to be accomplished for Owner by architects/engineers, contractors, and other others, including planning, study, design, construction, testing, commissioning, start-up, of which the Work to be performed under the Contract Documents is a part.

PROJECT SITE, means the specific real property on which the Work is to be performed, including designated contiguous staging areas, that is identified in the Plans, Specifications and Drawings.

PUNCH LIST, means the list of Work yet to be completed or deficiencies which need to be corrected in order to achieve Final Completion of the Contract.

RECORD DOCUMENT, means the as-built Plans, Specifications, testing and inspection records, product data, samples, manufacturer and distributor/supplier warranties evidencing transfer of ownership to Owner, operational and maintenance manuals, shop drawings, correspondence, certificate(s) of occupancy, and other documents listed in Subsection B.9.1 of these County General Conditions, recording all Services performed.

SAMPLES, means physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

SHOP DRAWINGS, means drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor (including any subsubcontractor), manufacturer, supplier, or distributor to illustrate some portion of the Work.

SOLICITATION DOCUMENT, means an Invitation to Bid, Request for Proposals, Request for Quotes, or other written document issued by Owner that outlines the required Specifications necessary to submit an Offer.

SPECIFICATION, means any description of the physical or functional characteristics of the Work, or of the nature of a supply, service or construction item included in the Solicitation Document. Specifications may include a description of any requirement for inspecting, testing or preparing a supply, service or construction item for delivery and the quantities or qualities of materials to be furnished under the Contract. Specifications generally will state the results or products to be obtained and may, on occasion, describe the method and manner of doing the Work to be performed. Specifications may be incorporated by reference and/or may be attached to the Contract.

SUBCONTRACTOR, means a Person having a direct contract with the Contractor, or another Subcontractor of any tier, to perform one or more items of the Work.

SUBSTANTIAL COMPLETION, means the date when the Owner accepts in writing the construction, alteration or repair constituting the Work or any designated portion thereof as having reached that state of completion when it may be used or occupied for its intended purpose. Substantial Completion of facilities with operating systems occurs only after thirty (30) continuous Days of successful, trouble-free operation of the operating systems as provided in Section K.3.2.

SUBSTITUTIONS, means items that in function, performance, reliability, quality, and general configuration are the same or better than the product(s) specified. Substitutions also means the performance of the Work by a labor force other than what is submitted in the Offer.

SUPPLEMENTAL GENERAL CONDITIONS, means those conditions that remove from, add to, or modify these County General Conditions. Public Improvement Supplemental General Conditions may be included in the Solicitation Document or may be a separate attachment to the Contract.

UNAVOIDABLE DELAYS, mean delays other than Avoidable Delays that are: (a) to the extent caused by any actions of the Owner, or any other employee or agent of the Owner, or by a separate contractor employed by the Owner; (b) to the extent caused by any Project Site conditions which differ materially from the conditions that would normally be expected to exist and inherent to the construction activities defined in the Contract Documents; or (c) to the extent caused by Force Majeure acts, or events or occurrences.

WORK, means the furnishing of all materials, equipment, labor, transportation, services, incidentals, those permits and regulatory approvals not provided by the owner necessary to successfully complete any individual item or the entire Contract and the carrying out of duties and obligations imposed by the Contract Documents for the Project.

A.2 SCOPE OF WORK

The Work contemplated under the Contract includes all labor, materials, transportation, equipment and services for, and incidental to, the completion of all work in connection with the Project described in the Contract Documents. The Contractor shall perform all Work necessary so that the Project can be legally occupied and fully used for the intended use as set forth in the Contract Documents.

A.3 INTERPRETATION OF CONTRACT DOCUMENTS

A.3.1 Unless otherwise specifically defined in the Contract Documents, words which have well-known technical meanings or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Contract Documents are intended to be complementary. Whatever is called for in one, is interpreted to be called for in all. However, in the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following descending order of precedence:

(a) The Contract and any amendments thereto, including Change Orders, with those of later date having precedence over those of an earlier date;
(b) The Supplemental General Conditions;
(c) County General Conditions;
(d) Plans and Specifications;
(e) The Solicitation Document, and any addenda thereto.

A.3.2 In the case of an inconsistency between Plans and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Owner's interpretation in writing as determined in Owners sole discretion.

A.3.3 If the Contractor finds discrepancies in, or omissions from the Contract Documents, or if the Contractor is in doubt as to their meaning, the Contractor shall at once notify the Owner. Matters concerning and interpretation of requirements of the Contract Documents will be decided by the Owner in the Owner's sole discretion, who may delegate that duty in some instances to the Architect/Engineer. Responses to Contractor's requests for interpretation of Contract Documents will be made in writing by Owner (or the Architect/Engineer) within any time limits agreed upon or otherwise with reasonable promptness. Contractor shall not proceed without direction in writing from the Owner (or Architect/Engineer).

A.3.4 References to standard specifications, manuals, codes of any technical society, organization or association, to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, laws or regulations in effect in the jurisdiction where the Project Site is located on the first published date of the Solicitation Document, except as may be otherwise specifically stated.

A.4 EXAMINATION OF PLANS, SPECIFICATIONS, AND PROJECT SITE

A.4.1 It is understood that the Contractor, before submitting an Offer, has made a careful examination of the Contract Documents; has become fully informed as to the quality and quantity of materials and the character of the Work required; and has made a careful examination of the location and conditions of the Work and the sources of supply for materials. The Owner will in no case be responsible for any loss or for any unanticipated costs that may be suffered by the Contractor as a result of the Contractor's failure to acquire full information in advance in regard to all conditions pertaining to the Work. No oral agreement or conversation with any officer, agent, or personnel of the Owner, or with the Architect/Engineer either before or after the execution of the Contract, shall affect or modify any of the terms or obligations herein contained. Contractor shall at all times be responsible for all utility locates regardless of the ownership of such utility infrastructure or service.

A.4.2 Should the Plans or Specifications fail to particularly describe the materials, kind of goods, or details of construction of any aspect of the Work, Contractor shall have the duty to make inquiry of the Owner and Architect/Engineer as to what is required prior to performance of the Work. Absent Specifications to the contrary, the materials or processes that would normally be used to produce first quality finished Work shall be considered a part of the Contract requirements.

A.4.3 Any design errors or omissions noted by the Contractor shall be reported promptly to the Owner, including without limitation, any nonconformity with Applicable Laws.

A.4.4 If the Contractor believes that adjustments to cost or Contract Time are involved because of clarifications or instructions issued by the Owner (or Architect/Engineer) in response to the Contractor's notices or requests for information, the Contractor must submit a written request to the Owner, setting forth the nature and specific extent of the request, including all time and cost impacts against the Contract as soon as possible, but no later than thirty (30) Days after receipt by Contractor of the clarifications or instructions issued. If the Owner denies Contractor's request for additional compensation, additional Contract Time, or other relief that Contractor believes results from the clarifications or instructions, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process. If the Contractor fails to perform the obligations of Sections A.4.1 to A.4.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations.

A.4.5 If the Contractor believes that adjustments to cost or Contract Time are involved because of an Unavoidable Delay caused by differing Project Site conditions, the Contractor shall notify the Owner immediately of differing Project Site conditions before the area has been disturbed. The Owner will investigate the area and make a determination as to whether or not the conditions differ materially from either the conditions stated in the Contract Documents or those which could reasonably be expected in execution of this particular Contract. If Contractor and the Owner agrees that a differing Project Site condition exists, any adjustment to compensation or Contract Time will be determined based on the process set forth in Section D.2.2 for adjustments to or deletions from Work. If the Owner disagrees that a differing Project Site condition exists and denies Contractor's request for additional compensation or Contract Time, Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

A.5 INDEPENDENT CONTRACTOR STATUS

The service or services to be performed under the Contract are those of an independent contractor as defined in ORS 670.600. Contractor represents and warrants that it is not an officer, employee or agent of the Owner as those terms are used in ORS 30.265.

A.6 RETIREMENT SYSTEM STATUS AND TAXES

Contractor represents and warrants that it is not a contributing member of the Public Employees' Retirement System and will be responsible for any federal or state taxes applicable to payment received under the Contract. Contractor will not be eligible for any benefits from these Contract payments of federal Social Security, employment insurance, workers' compensation or the Public Employees' Retirement System, except as a self-employed individual. Unless the Contractor is subject to backup withholding, Owner will not withhold from such payments any amount(s) to cover Contractor's federal or state tax obligations.

A.7 GOVERNMENT EMPLOYMENT STATUS

A.7.1 If this payment is to be charged against federal funds, Contractor represents and warrants that it is not currently employed by the Federal Government. This does not preclude the Contractor from holding another contract with the Federal Government.

SECTION B
ADMINISTRATION OF THE CONTRACT

B.1 OWNER'S ADMINISTRATION OF THE CONTRACT

B.1.1 The Owner shall administer the Contract as described in the Contract Documents throughout the term of the Contract, including the one-year period for correction of Work. The Owner will act as provided in the Contract Documents, unless modified in writing in accordance with other provisions of the Contract. In performing these tasks, the Owner may rely on the Architect/Engineer or other agents to perform some or all of these tasks.

B.1.2 The Owner may visit the Project Site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. The Owner will not

make exhaustive or continuous on-Project Site inspections to check the quality or quantity of the Work. Unless otherwise required in a Change Order, the Owner will neither have control over or charge of, nor be responsible for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work.

B.1.3 Except as otherwise provided in the Contract Documents or when direct communications have been specifically authorized, the Owner and Contractor shall communicate with each other within a reasonable time frame about matters arising out of or relating to the Contract. Communications by and with the Architect/Engineer's consultants shall be through the Architect/Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

B.1.4 Based upon the Architect/Engineer's evaluations of the Contractor's Application for Payment, or unless otherwise stipulated by the Owner, the Architect/Engineer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

B.2 CONTRACTOR'S MEANS AND METHODS; MITIGATION OF IMPACTS

B.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the Project Site safety thereof and, except as stated below, shall be fully and solely responsible for the Project Site safety of such means, methods, techniques, sequences or procedures.

B.2.2 The Contractor is responsible to protect and maintain the Work during the course of construction and to mitigate any adverse impacts to the Project, including those caused by authorized changes, which may affect cost, schedule, or quality.

B.2.3 The Contractor is responsible for the actions of all its personnel, laborers, suppliers, agents, and Subcontractors on the Project. The Contractor shall enforce strict discipline and good order among Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of persons who are unfit or unskilled for the tasks assigned to them.

B.3 MATERIALS AND WORKMANSHIP

B.3.1 The intent of the Contract Documents is to provide for the construction and completion of every detail of the Work described. All Work shall be performed in a professional manner and, unless the means or methods of performing a task are specified elsewhere in the Contract Documents, Contractor shall employ methods that are generally accepted and used by the industry, in accordance with industry standards.

B.3.2 The Contractor is responsible to perform the Work as required by the Contract Documents. Defective Work shall be corrected at the Contractor's sole expense and within a reasonable time frame.

B.3.3 Work done and materials furnished may be subject to inspection and/or observation and testing by the Owner to determine if they conform to the Contract Documents. Inspection of the Work by the Owner does not relieve the Contractor of responsibility for the Work in accordance with the Contract Documents.

B.3.4 Contractor shall furnish adequate facilities, as required, for the Owner to have safe access to the Work including without limitation walkways, railings, ladders, tunnels, and platforms. Producers, suppliers, and fabricators shall also provide proper facilities and access to their facilities.

B.3.5 The Contractor shall furnish Samples of materials for testing by the Owner and include the cost of the Samples in the Contract Price.

B.4 PERMITS

Contractor shall obtain and pay for all necessary permits, licenses and fees, except for those specifically excluded in the Supplemental General Conditions, as required for the project. Contractor shall be responsible for all violations of the law. Contractor shall give all requisite notices to public authorities.

B.5 COMPLIANCE WITH GOVERNMENT REGULATIONS

B.5.1 Contractor shall comply with Applicable Laws, as amended pertaining to the Work and the Contract. Failure to comply with such requirements shall constitute a breach of Contract and shall be grounds for Contract termination. Without limiting the generality of the foregoing, Contractor expressly agrees to comply with the following, as applicable and as may be amended from time to time: (i) Title VI and VII of Civil Rights Act of 1964, as amended; (ii) Section 503 and 504 of the Rehabilitation Act of 1973, as amended; (iii) the Health Insurance Portability and Accountability Act of 1996; (iv) the Americans with Disabilities Act of 1990, as amended; (v) ORS Chapter 659A; as amended; (vi) all regulations and administrative rules established pursuant to any applicable laws; and (vii) all other applicable requirements of federal, state, county or other local government entity statutes, rules and regulations.

B.5.2 Contractor shall comply with all applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations, and

(a) Contractor shall not discriminate against Disadvantaged, Minority, Women or Emerging Small Business enterprises, as those terms are defined in ORS 200.005, or a business enterprise that is owned or controlled by or that employs a disabled veteran, as that term is defined in ORS 408.225, in the awarding of subcontracts.

(b) Contractor shall maintain, in current and valid form, all licenses and certificates required by Applicable Laws or the Contract when performing the Work.

B.5.3 Contractor shall certify that it shall not accept a bid from Subcontractors to perform Work unless such Subcontractors are registered with the Construction Contractors Board in accordance with ORS 701.021 at the time they submit their bids to the Contractor.

B.5.4 Contractor shall certify that each landscape contracting business, as defined in ORS 671.520(2), performing Work under the Contract holds a valid landscape construction professional license issued pursuant to ORS 671.560.

B.5.5 The following notice is applicable to Contractors who perform excavation Work. ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain copies of the rules by calling the center at (877) 668-4001.

B.5.6 Failure to comply with any or all of the requirements of B.5.1 through B.5.5 shall be a material breach of Contract and constitute

grounds for Contract termination. Damages or costs resulting from such noncompliance shall be the responsibility of Contractor.

B.5.7 The Contractor shall include in each subcontract those provisions required under ORS 279C.580.

B.5.8 Contractor shall comply with ORS 652.220, compliance of which is a material element of this Contract and failure to comply is a material breach that entitles County to exercise any rights and remedies available under this Contract including, but not limited to, termination for default.

B.6 SUPERINTENDENCE

Contractor shall keep on the Project Site, during the progress of the Work, a competent superintendent and any necessary assistants who shall be satisfactory to the Owner and who shall represent the Contractor on the Project Site. Directions given to the superintendent by the Owner shall be confirmed in writing to the Contractor.

B.7 INSPECTION

B.7.1 Owner shall have access to the Work at all times.

B.7.2 Inspection of the Work will be made by the Owner at its discretion. The Owner will have authority to reject Work that does not conform to the Contract Documents in the Owner's sole discretion. Any Work found to be not in conformance with the Contract Documents, in the discretion of the Owner, shall be removed and replaced at the Contractor's expense.

B.7.3 Contractor shall make or obtain at the appropriate time all tests, inspections and approvals of portions of the Work required by the Contract Documents or by Applicable Laws or orders of public authorities having jurisdiction. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work. The Contractor shall give the Owner timely notice of when and where tests and inspections are to be made so that the Owner may be present for such procedures. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Owner.

B.7.4 As required by the Contract Documents, Work done or material used without required inspection or testing and/or without providing timely notice to the Owner may be ordered removed at the Contractor's expense.

B.7.5 If directed to do so by Owner or other permitting authority any time before the Work is accepted, the Contractor shall uncover portions of the completed Work for inspection. After inspection, the Contractor shall restore such portions of Work to the standard required by the Contract. If the Work uncovered is unacceptable or was done without required testing or inspection or sufficient notice to the Owner, the uncovering and restoration shall be done at the Contractor's expense. If the Work uncovered is acceptable and was done with sufficient notice to the Owner, the uncovering and restoration will be paid for pursuant to a Change Order.

B.7.6 If any testing or inspection reveals failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Owner's and Architect/Engineer's services and expenses, shall be at the Contractor's expense.

B.7.7 In Owner's sole discretion, it may authorize other interested parties to inspect the Work affecting their interests or property. Their right to inspect shall not make them a party to the Contract and shall not interfere with the rights of the parties of the Contract. Instructions or orders of such parties shall be transmitted to the Contractor, through the Owner.

B.8 SUBCONTRACTS AND ASSIGNMENT

B.8.1 Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound by the terms and conditions of these General Conditions and Supplemental General Conditions, and to assume toward the Contractor all of the obligations and responsibilities which the Contractor assumes toward the Owner thereunder, unless (1) the same are clearly inapplicable to the subcontract at issue because of legal requirements or industry practices, or (2) specific exceptions are requested by Contractor and approved in writing by Owner. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with sub-subcontractors at any level.

B.8.2 At Owner's request, Contractor shall submit to Owner prior to their execution either Contractor's form of subcontract, or the subcontract to be executed with any particular Subcontractor. If Owner disapproves such form, Contractor shall not execute the form until the matters disapproved are resolved to Owner's satisfaction. Owner's review, comment upon or approval of any such form shall not relieve Contractor of its obligations under this Agreement or be deemed a waiver of such obligations of Contractor.

B.8.3 Contractor shall not assign, sell, or transfer its rights, or delegate its responsibilities under the Contract, in whole or in part, without the prior written approval of the Owner. No such written approval shall relieve Contractor of any obligations of the Contract, and any transferee shall be considered the agent of the Contractor and bound to perform in accordance with the Contract Documents. Contractor shall remain liable as between the original parties to the Contract as if no assignment had occurred.

B.9 OWNER'S RIGHT TO DO WORK

Owner reserves the right to perform other or additional work at or near the Project Site with other agents than those of the Contractor. If such work takes place within or next to the Project Site, Contractor shall coordinate work with the other contractors or agents, cooperate with all other contractors or forces, carry out the Work in a way that will minimize interference and delay for all agents involved, place and dispose of materials being used so as not to interfere with the operations of another, and join the Work with the work of the others in an acceptable manner and perform it in proper sequence to that of the others. The Owner will resolve any disagreements that may arise between or among Contractor and the other contractors over the method or order of doing all work (including the Work). In case of unavoidable interference, the Owner will establish work priority (including the Work) in the Owner's sole discretion.

B.10 OTHER CONTRACTS

In all cases and at any time, the Owner has the right to execute other contracts related to or unrelated to the Work of the Contract. The Contractor of the Contract shall fully cooperate with any and all other contractors without additional cost to the Owner in the manner described in Section B.13.

B.11 ALLOWANCES

B.11.1 The Contractor shall include in the Contract Price all allowances stated in the Contract Documents. Items covered by allowances

shall be supplied for such amounts and by such persons or entities as the Owner may direct.

B.11.2 Unless otherwise provided in the Contract Documents:

(a) when finally reconciled, allowances shall cover the cost of the Contractor's materials and equipment delivered at the Project Site and all required taxes, less applicable trade discounts;

(b) Contractor's costs for unloading and handling at the Project Site, labor, installation costs, Overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Price but not in the allowances;

(c) whenever costs are more than or less than allowances, the Contract Price shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (i) the difference between actual costs and the allowances under Section B.17.2(a) and (ii) changes in Contractor's costs under Section B.17.2(b);

(d) Unless Owner requests otherwise, Contractor shall provide to Owner a proposed fixed price for any allowance work prior to its performance.

B.12 SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

B.12.1 The Contractor shall prepare and keep current, for the Architect's/Engineer's approval (or for the approval of Owner if approval authority has not been delegated to the Architect/Engineer), a schedule and list of submittals which is coordinated with the Contractor's construction schedule and allows the Architect/Engineer reasonable time to review submittals. Owner reserves the right to finally approve the schedule and list of submittals. Submittals include, without limitation, Shop Drawings, Product Data, and Samples.

B.12.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review of submittals by the Architect/Engineer is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, or for approval of safety precautions or, unless otherwise specifically stated by the Architect/Engineer, of any construction means, methods, techniques, sequences or procedures, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect/Engineer's review of the Contractor's submittals shall not relieve the Contractor of its obligations under the Contract Documents. The Architect/Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component. Informational submittals upon which the Architect/Engineer is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect/Engineer without action.

B.12.3 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect/Engineer Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect/Engineer without action.

B.12.4 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

B.12.5 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect/Engineer.

B.12.6 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect/Engineer's review or approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect/Engineer in writing of such deviation at the time of submittal and (i) the Architect/Engineer has given written approval to the specific deviation as a minor change in the Work, or (ii) a Change Order has been executed by Owner authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect/Engineer's review or approval thereof.

B.12.7 In the event that Owner elects not to have the obligations and duties described under this Section B.18 performed by the Architect/Engineer, or in the event no Architect/Engineer is employed by Owner on the Project, all obligations and duties assigned to the Architect/Engineer hereunder shall be performed by the Owner.

B.13 SUBSTITUTIONS

The Contractor may make Substitutions only with the written consent of the Owner, after evaluation by the Owner and only in accordance with a Change Order. Substitutions shall be subject to the requirements of the Solicitation Document. By making requests for Substitutions, the Contractor represents that the Contractor has personally investigated the proposed substitute product; represents that the Contractor will provide the same warranty for the Substitution that the Contractor would for the product originally specified unless approved otherwise; certifies that the cost data presented is complete and includes all related costs under the Contract including redesign costs, and waives all claims for additional costs related to the Substitution which subsequently become apparent; and will coordinate the installation of the accepted Substitution, making such changes as may be required for the Work to be completed in all respects.

B.14 USE OF PLANS AND SPECIFICATIONS

Plans, Specifications and related Contract Documents furnished to Contractor by Owner or Owner's Architect/Engineer shall be used solely for the performance of the Work under the Contract. Contractor and its Subcontractors and suppliers are authorized to use and reproduce applicable portions of such documents appropriate to the execution of the Work, but shall not claim any ownership or other interest in them beyond the scope of the Contract, and no such interest shall attach. Unless otherwise indicated, all common law, statutory and other reserved rights, in addition to copyrights, are retained by Owner.

SECTION C
WAGES AND LABOR

C.1 PREVAILING WAGE RATES ON PUBLIC WORKS

Contractor shall comply fully with the provisions of ORS 279C.800 through 279C.870. Pursuant to ORS 279C.830(1)(d), Contractor shall pay workers at not less than the specified minimum hourly rate of wage, and shall include that requirement in all subcontracts. If the Work is subject to both the state prevailing wage rate law and the federal Davis-Bacon Act, Contractor shall pay the higher of the applicable state or federal prevailing rate of wage. Contractor shall provide written notice to all workers of the number of hours per day and days per week such workers may be required to work.

C.2 PAYROLL CERTIFICATION AND FEE REQUIREMENTS

C.2.1 In accordance with ORS 279C.845, the Contractor and every Subcontractor shall submit written certified statements to the Owner on the form prescribed by the Commissioner of the Bureau of Labor and Industries ("BOLI"), certifying the hourly rate of wage paid each worker which the Contractor or the Subcontractor has employed on the Project and further certifying that no worker employed on the Project has been paid less than the prevailing rate of wage or less than the minimum hourly rate of wage specified in the Contract, which certificate and statement shall be verified by the oath of the Contractor or the Subcontractor that the Contractor or Subcontractor has read the certified statement, that the Contractor or Subcontractor knows the contents of the certified statement, and, that to the Contractor's or Subcontractor's best knowledge and belief, the certified statement is true. The certified statements shall set out accurately and completely the payroll records for the prior week, including the name and address of each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Certified statements for each week during which the Contractor or Subcontractor has employed a worker on the Project shall be submitted once a month, by the fifth (5^{th}) business day of the following month. The Contractor and Subcontractors shall preserve the certified statements for a period of ten (10) years from the date of completion of the Contract.

C.2.2 Pursuant to ORS 279C.845(7), the Owner shall retain 25 percent of any amount earned by the Contractor on the Project until the Contractor has filed the certified statements required by section C.2.1. The Owner shall pay to the Contractor the amount retained under this subsection within 14 days after the Contractor files the required certified statements, regardless of whether a Subcontractor has failed to file certified statements.

C.2.3 Pursuant to ORS 279C.845(8), the Contractor shall retain 25 percent of any amount earned by a first-tier Subcontractor on this Project until the first-tier Subcontractor has filed with the Owner the certified statements required by C.2.1. Before paying any amount retained under this subsection, the Contractor shall verify that the first-tier Subcontractor has filed the certified statement. Within 14 days after the first-tier Subcontractor files the required certified statement the Contractor shall pay the first-tier Subcontractor any amount retained under this subsection.

C.2.4 In accordance with statutory requirements and administrative rules promulgated by the Commissioner of the Bureau of Labor and Industries, the fee required by ORS 279C.825(1) will be paid by Owner to the Commissioner.

C.3 PROMPT PAYMENT AND CONTRACT CONDITIONS

C.3.1 As a condition to Owner's performance hereunder, the Contractor shall:

C.3.1.1 Make payment promptly, as due, to all persons supplying to Contractor labor or materials for the prosecution of the Work provided for in the Contract.

C.3.1.2 Pay all contributions or amounts due the State Industrial Accident Fund or successor program from such Contractor or Subcontractor incurred in the performance of the Contract.

C.3.1.3 Not permit any lien or claim to be filed or prosecuted against the Owner on account of any labor or material furnished. Contractor will not assign any claims that Contractor has against Owner, or assign any sums due by Owner, to Subcontractors, suppliers, or manufacturers, and will not make any agreement or act in any way to give Subcontractors a claim or standing to make a claim against the Owner.

C.3.1.4 Pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.

C.3.2 If Contractor fails, neglects or refuses to make prompt payment of any claim for labor or services furnished to the Contractor of a Subcontractor by any person in connection with the Project as such claim becomes due, the proper officer(s) representing the Owner may pay the claim and charge the amount of the payment against funds due or to become due Contractor under the Contract. Payment of claims in this manner shall not relieve the Contractor or the Contractor's surety from obligation with respect to any unpaid claims.

C.3.3 Contractor shall include in each subcontract for property or services entered into by the Contractor and a first-tier subcontractor, including a material supplier, for the purpose of performing a construction contract, a payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under its subcontract within ten (10) Days out of such amounts as are paid to the Contractor by the Owner under such contract.

C.3.4 If the Contractor or a first-tier subcontractor fails, neglects or refuses to pay a person that provides labor or materials in connection with the Contract within 30 days after receiving payment from the contracting agency or a contractor, the Contractor or first-tier subcontractor owes the person the amount due plus interest charges that begin at the end of the 10-day period within which payment is due under ORS 279C.580 (4) and that end upon final payment, unless payment is subject to a good faith dispute as defined in ORS 279C.580. The rate of interest on the amount due is nine percent per annum. The amount of interest may not be waived.

C.3.5 If the Contractor or a subcontractor fails, neglects or refuses to make payment to a person furnishing labor or materials in connection with the Contract, the person may file a complaint with the Construction Contractors Board, unless payment is subject to a good faith dispute as defined in ORS 279C.580.

C.3.6 All employers, including Contractor, that employ subject workers who work under the Contract in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. Contractor shall ensure that each of its Subcontractors complies with these requirements.

C.3.7 In accordance with ORS 279C.570, for all subcontracts that exceed $500,000 that the Contractor withholds retainage, the Contractor shall place amounts deducted as retainage into an interest-bearing escrow account. Interest on the retainage amount accrues from the

date the payment request is approved until the date the retainage is paid to the Subcontractor to which it is due.

C.4 PAYMENT FOR MEDICAL CARE

As a condition to Owner's performance hereunder, Contractor shall promptly, as due, make payment to any person, co-partnership, association or corporation furnishing medical, surgical, and hospital care or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums of which the Contractor agrees to pay for the services and all moneys and sums that the Contractor collected or deducted from the wages of employees under any law, contract or agreement for the purpose of providing or paying for the services.

C.5 HOURS OF LABOR

As a condition to Owner's performance hereunder, no person shall be employed to perform Work under the Contract for more than ten (10) hours in any one day or forty (40) hours in any one week, except in cases of necessity, emergency or where public policy absolutely requires it. In such instances, Contractor shall pay the employee at least time and a half pay:

(a) For all overtime in excess of eight (8) hours a day or forty (40) hours in any one week when the work week is five consecutive Days, Monday through Friday; or

(b) For all overtime in excess of ten (10) hours a day or forty (40) hours in any one week when the work week is four consecutive Days, Monday through Friday; and

(c) For all Work performed on Saturday and on any legal holiday specified in ORS 279C.540.

This Section C.5 will not apply to Contractor's Work under the Contract to the extent Contractor is currently a party to a collective bargaining agreement with any labor organization.

This Section C.5 shall not excuse Contractor from completion of the Work within the time required under the Contract.

SECTION D
CHANGES IN THE WORK

D.1 CHANGES IN WORK

D.1.1 The terms of the Contract shall not be waived, altered, modified, supplemented or amended in any manner whatsoever, without prior written agreement and then only after any necessary approvals have been obtained. A Change Order is required to modify the Contract, which shall not be effective until its execution by the parties to the Contract and all approvals required by public contracting laws have been obtained.

D.1.2 It is mutually agreed that changes in Plans, quantities, or details of construction may be necessary or desirable during the course of construction. Within the general scope of the Contract, the Owner may at any time, without notice to the sureties and without impairing the Contract, require changes it deems necessary or desirable within the scope of this Project and consistent with this Section D.1. All changes to the Work shall be documented and Change Orders shall be executed under the conditions of the Contract Documents. Such changes may include, but are not limited to:

(a) Modification of specifications and design.
(b) Increases or decreases in quantities.
(c) Increases or decreases to the amount of Work.
(d) Addition or elimination of any Work item.
(e) Change in the duration of the Project.
(f) Acceleration or delay in performance of Work.
(g) Deductive changes.

Deductive changes are those that reduce the scope of the Work, and shall be made by mutual agreement whenever feasible. In cases of suspension or partial termination under Section J, Owner reserves the right to unilaterally impose a deductive change and to self-perform such Work, for which the provisions of Section B.13 (Owner's Right to Do Work) shall then apply. Adjustments in compensation shall be made under Section D.1.3, in which costs for deductive changes shall be based upon a Direct Costs adjustment together with the related percentage markup specified for profit, Overhead and other indirect costs, unless otherwise agreed to by Owner.

D.1.3 The Owner and Contractor agree that adjustments to or deletions from the Work shall be administered and compensated according to the following:

(a) Unit Pricing: Unit pricing may be utilized at the Owner's option when unit prices or solicitation alternates were provided that established the cost for adjustments to Work, and a binding obligation exists under the Contract on the parties covering the terms and conditions of the adjustment to Work.

(b) Fixed Fee: If the Owner elects not to utilize unit pricing, or in the event that unit pricing is not available or appropriate, fixed pricing may be used for adjustments to or deletions from the Work. In fixed pricing, the basis of payments or total price shall be agreed upon in writing between the parties to the Contract, and shall be established before the Work is done whenever feasible. Notwithstanding the foregoing, the mark-ups set forth in Section D.1.3(c) shall be utilized in establishing fixed pricing, and such mark-ups shall not be exceeded. Cost and price data relating to adjustments to or deletions from the Work shall be supplied by Contractor to Owner upon request, but Owner shall be under no obligation to make such requests.

(c) Time and Material: In the event that unit pricing and fixed pricing are not utilized, then adjustments to or deletions from the Work shall be performed on a cost reimbursement basis for Direct Costs. Such Work shall be compensated on the basis of the actual, reasonable and allowable cost of labor, equipment, and material furnished on the Work performed. The Contractor or Subcontractor who performs the Work shall be allowed to add up to ten percent (10%) markup to the Direct Costs as full compensation for profit, Overhead and other indirect costs for Work performed with the Contractor's or Subcontractor's own agents

Each ascending tier Subcontractor or the Contractor that did not perform the Work, will be allowed to add up to five percent (5%) supplemental markup on the Direct Costs of the Work (but not the above allowable markups) covered by a Change Order. No additional markup shall be permitted for any third tier or greater descending Subcontractor.

Example: $20,000 of Direct Costs Work performed by a 2nd Tier Subcontractor

	Markup	Allowed Total Fee Plus Markup
General Contractor	5%	$1,000.00
1st Tier Sub Contractor	5%	$1,000.00
2nd Tier Sub Contractor	10%	$22,000.00

(d) Payments made to the Contractor shall be complete compensation for Overhead, profit, and all costs that were incurred by the Contractor or by other agents furnished by the Contractor, including Subcontractors, for adjustments to or deletions from the Work pursuant to a Change Order. Owner may establish a maximum cost for additional Work under this Section D.1.3, which shall not be exceeded for reimbursement without additional written

authorization from Owner in the form of a Change Order. Contractor shall not be required to complete such additional Work without additional authorization.

D.1.4 Any necessary adjustment of Contract Time that may be required as a result of adjustments to or deletions from the Work must be agreed upon by the parties before the start of the revised Work unless Owner authorizes Contractor to start the revised Work before agreement on Contract Time adjustment.

Contractor shall submit any request for additional compensation (and additional Contract Time if Contractor was authorized to start Work before an adjustment of Contract Time was approved) as soon as possible but no later than thirty (30) Days after receipt of Owner's request for additional Work . If Contractor's request for additional compensation or adjustment of Contract Time is not made within the thirty (30) Day time limit, Contractor's requests pertaining to that additional Work shall be barred. The thirty (30) Day time limit for making requests shall not be extended for any reason, including without limitation Contractor's claimed inability to determine the amount of additional compensation or adjustment of Contract Time, unless an extension is granted in writing by Owner. If the Owner denies Contractor's request for additional compensation or adjustment of Contract Time, Contractor may proceed to file a Claim under Section D.3, Claims Review Process. No other reimbursement, compensation, or payment will be made, except as provided in Section D.1.5 for impact claims.

D.1.5 If any adjustment to Work under Section D.1.3 causes an increase or decrease in the Contractor's cost of, or the Contract Time required for the performance of any other part of the Work under the Contract, Contractor shall submit a written request to the Owner, setting forth the nature and specific extent of the request, including all time and cost impacts against the Contract as soon as possible, but no later than thirty (30) Days after receipt of Owner's request for adjustments to or deletions from the Work by Contractor.

The thirty (30) Day time limit applies to claims of Subcontractors, suppliers, or manufacturers who may be affected by Owner's request for adjustments to or deletions from the Work and who request additional compensation or an extension of Contract Time to perform; Contractor has responsibility for contacting its Subcontractors, suppliers, or manufacturers within the thirty (30) Day time limit, and including their requests with Contractor's requests. If the request involves Work to be completed by Subcontractors, or materials to be furnished by suppliers or manufacturers, such requests shall be submitted to the Contractor in writing with full analysis and justification for the adjustments to compensation and Contract Time requested. The Contractor shall analyze and evaluate the merits of the requests submitted by Subcontractors, suppliers, and manufacturers to Contractor prior to including those requests and Contractor's analysis and evaluation of those requests with Contractor's requests for adjustments to compensation or Contract Time that Contractor submits to the Owner. Failure of Subcontractors, suppliers, manufacturers or others to submit their requests to Contractor for inclusion with Contractor's requests submitted to Owner within the time period and by the means described in this section shall constitute a waiver of these Subcontractor claims. The Owner will not consider direct requests or claims from Subcontractors, suppliers, manufacturers or others not a party to the Contract. The consideration of such requests and claims under this section does not give any Person, not a party to the Contract the right to bring a claim against Owner, whether in this claims process, in litigation, or in any dispute resolution process.

If the Owner denies the Contractor's request for adjustment to compensation or Contract Time, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

D.1.6 No request or Claim by the Contractor for additional costs or an adjustment of Contract Time shall be allowed if made after receipt of final payment application under the Contract. Final payment application must be made by Contractor within the time required under Section E.6.4.

D.1.7 It is understood that changes in the Work are inherent in construction of this type. The number of changes, the scope of those changes, and the effect they have on the progress of the original Work cannot be defined at this time. The Contractor agrees that it will work in good faith with Owner to undertake changes, when agreed upon by execution of a Change Order. Each change will be evaluated for extension of Contract Time and increase or decrease in compensation based on its own merit.

D.2 DELAYS

D.2.1 Contractor shall not be entitled to additional compensation or additional Contract Time for Avoidable Delays.

D.2.2 In the event of Unavoidable Delays, Contractor may be entitled to the following:

(a) Contractor may be entitled to additional compensation or additional Contract Time, or both, for Unavoidable Delays described in Section D.2.1.2 (a) and (b).

(b) Contractor may be entitled to additional Contract Time for Unavoidable Delays described in Section D.2.1.2(c) and (d).

In the event of any requests for additional compensation or additional Contract Time, or both, as applicable, arising under this Section D.2.2 for Unavoidable Delays, other than requests for additional compensation or additional Contract Time for differing Project Site conditions for which a review process is established under Section A.4.5, Contractor shall submit a written notification of the delay to the Owner within two (2) Days of the occurrence of the cause of the delay. This written notification shall state the cause of the potential delay, the Project components impacted by the delay, and the anticipated additional Contract Time extension or the additional compensation, or both, as applicable, resulting from the delay. Within seven (7) Days after the cause of the delay has been mitigated, or in no case more than thirty (30) Days after the initial written notification, the Contractor shall submit to the Owner, a complete and detailed request for additional compensation or additional Contract Time, or both, as applicable, resulting from the delay. If the Owner denies Contractor's request for additional compensation or adjustment of Contract Time, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

If Contractor does not timely submit the notices required under this Section D.2, Contractor's Claim shall be barred.

D.3 CLAIMS REVIEW PROCESS

D.3.1 All Contractor Claims shall be referred to the Owner for review. Contractor's Claims, including Claims for adjustments to compensation or Contract Time, shall be submitted in writing by Contractor to the Owner within five (5) Days after a denial of Contractor's initial request for an adjustment of Contract terms, payment of money, extension of Contract Time or other relief, provided that such initial request has been submitted in accordance with the requirements and within the time limits established in these County General Conditions. Within thirty (30) Days after the initial Claim, Owner shall receive from Contractor a complete and detailed description of the Claim (the "Detailed Notice") that includes all information required by Section D.3.2. Unless the Claim is made in accordance with these time requirements, it shall be barred.

D.3.2 The Detailed Notice of the Claim shall be submitted in writing by Contractor and shall include all information, records and documentation necessary for the Owner to properly and completely evaluate the claim, including, but not limited to a detailed, factual statement of the basis of the Claim, pertinent dates, Contract provisions which support or allow the Claim, reference to or copies of any documents which support the Claim, the dollar value of the Claim, and the Contract Time adjustment requested for the Claim. If the Claim involves Work to be completed by Subcontractors, the Contractor will analyze and evaluate the merits of the Subcontractor claim prior to forwarding it and that analysis and evaluation to the Owner. The Owner will not consider direct claims from Subcontractors, suppliers, manufacturers, or others not a party to the Contract. Contractor agrees that it will make no agreement, covenant, or assignment, nor will it commit any other act that will permit or assist any Subcontractor, supplier, manufacturer, or other to directly or indirectly make a claim against Owner.

D.3.3 The Owner, through the Architect/Engineer (or other employee or agent assigned by the Owner) will review all Claims and take one or more of the following preliminary actions within ten (10) Days of receipt of the Detailed Notice of a Claim: (1) request additional supporting information from the Contractor; (2) inform the Contractor and Owner in writing of the time required for adequate review and response; (3) reject the Claim in whole or in part and identify the reasons for rejection; (4) recommend approval of all or part of the Claim; (5) arrange a meeting with the Contractor for formal review of the Claim; or (6) propose an alternate resolution.

D.3.4 Once the Engineer or Project Manager determines the Owner is in receipt of a properly submitted claim, the Engineer or Project Manager may arrange a meeting, as agreed by the parties, with the Contractor in order to present the claim for formal review and discussion. A person authorized by the Contractor to execute Change Orders on behalf of the Contractor must be present and attend all claim meetings.

D.3.5 The Owner's decision, through the Architect/Engineer (or other employee or agent assigned by the Owner), shall be final and binding on the Contractor unless appealed by written notice to the Owner within fifteen (15) Days of receipt of the decision. The Contractor must present written documentation supporting the Claim within fifteen (15) Days of the notice of appeal. After receiving the appeal documentation, the Owner, through the appropriate department director, shall review the materials and render a decision within thirty (30) Days after receiving the appeal documents.

D.3.6 If, at any step in the claim decision or review process, the Contractor fails to promptly submit requested information or documentation that the Owner deems necessary to analyze the claim, the Contractor is deemed to have waived its right to further review, and the Claim will not be considered properly filed and preserved.

D.3.7 Both parties agree to exercise their best efforts in good faith to resolve all disputes within sixty (60) Days of the issuance of the appeal in Section D. 3.4 above. If the parties are unable to resolve their issues through mediation or otherwise, either party may seek redress through all available remedies in equity or in law.

D.3.8 Unless otherwise directed by Owner, Contractor shall proceed with the Work while any Claim, or mediation or litigation arising from a Claim, is pending. Regardless of the review period or the final decision of the Owner, the Contractor shall continue to diligently pursue the Work as identified in the Contract Documents. In no case is the Contractor justified or allowed to cease or delay Work, in whole or in part, without a written stop work order from the Owner.

SECTION E
PAYMENTS

E.1 SCHEDULE OF VALUES

The Contractor shall submit, by or before the pre-construction conference (as described in Section H.1.3), a schedule of values ("Schedule of Values") for the Contract Work. This schedule shall provide a breakdown of values for the Contract Work and will be the basis for progress payments. The breakdown shall demonstrate reasonable, identifiable, and measurable components of the Work. Unless objected to by the Owner, this schedule shall be used as the basis for reviewing Contractor's applications for payment. If objected to by Owner, Contractor shall revise the schedule of values and resubmit the same for approval of Owner.

E.2 APPLICATIONS FOR PAYMENT

E.2.1 Owner shall make progress payments on the Contract monthly as Work progresses, in accordance with the requirements of this Section E.2 and ORS 279C.570. Applications for payment shall be based upon estimates of Work completed and the Schedule of Values. As a condition precedent to Owner's obligation to pay, all applications for payment shall be approved by the Owner. A progress payment shall not be considered acceptance or approval of any Work or waiver of any defects therein. Owner shall pay to Contractor interest in accordance with ORS 279C.570 for overdue invoices, not including retainage, due the Contractor. Overdue invoices will be those that have not been paid within the earlier of:

(a) Thirty (30) days after receipt of the invoice; or

(b) Fifteen (15) days after the payment is approved by the County.

Notwithstanding the foregoing, in instances when an application for payment is filled out incorrectly, or when there is any defect or impropriety in any submitted application or when there is a good faith dispute, Owner shall so notify the Contractor within fifteen (15) Days stating the reason or reasons the application for payment is defective or improper or the reasons for the dispute. A defective or improper application for payment, if corrected by the Contractor within seven (7) Days of being notified by the Owner, shall not cause a payment to be made later than specified in this section unless interest is also paid. Payment of interest will be postponed when payment on the principal is delayed because of disagreement between the Owner and the Contractor.

Owner reserves the right, instead of requiring the Contractor to correct or resubmit a defective or improper application for payment, to reject the defective or improper portion of the application for payment and pay the remainder of the application for such amounts which are correct and proper.

Owner, upon written notice to the Contractor, may elect to make payments to the Contractor only by means of Electronic Funds Transfers ("EFT") through Automated Clearing House ("ACH") payments. If Owner makes this election, the Contractor shall arrange for receipt of the EFT/ACH payments.

E.2.2 Contractor shall submit to the Owner an application for each payment and, if required, receipts or other vouchers showing payments for materials and labor including payments to Subcontractors. Contractor shall include in its application for payment a schedule of the percentages of the various parts of the Work completed, based on the Schedule of Values which shall aggregate to the payment application total, and shall include, on the face of each copy thereof, a certificate in substantially the following form:

"I, the undersigned, hereby certify that the above bill is true and correct, and the payment therefore, has not been received.

Signed: _____
Dated: _____"

E.2.3 Generally, applications for payment will be accepted only for materials that have been installed. Under special conditions, applications for payment for stored materials will be accepted at Owner's sole discretion. Such a payment, if made, will be subject to the following conditions:

(a) The request for stored material shall be submitted at least thirty (30) Days in advance of the application for payment on which it appears. Applications for payment shall be entertained for major equipment, components or expenditures only.

(b) The Contractor shall submit applications for payment showing the quantity and cost of the material stored.

(c) The material shall be stored in a bonded warehouse and Owner shall be granted the right to access the material for the purpose of removal or inspection at any time during the Contract Period.

(d) The Contractor shall name the Owner as co-insured on the insurance policy covering the full value of the property while in the care and custody of the Contractor until it is installed. A certificate noting this coverage shall be issued to the Owner.

(e) Payments shall be made for materials and equipment only. The submitted amount in the application for payment shall be reduced by the cost of transportation from the storage site to the Project Site and for the cost of an inspector to verify delivery and condition of the goods at the storage site. The cost of storage and inspection shall be borne solely by the Contractor.

(f) Within sixty (60) Days of the application for payment, the Contractor shall submit evidence of payment covering the material and/or equipment stored and of payment for the storage site.

(g) Payment for stored materials and/or equipment shall in no way indicate acceptance of the materials and/or equipment or waive any rights under the Contract for the rejection of the Work or materials and/or equipment not in conformance with the Contract Documents.

(h) All required documentation shall be submitted with the respective application for payment.

E.2.4 The Owner reserves the right to withhold all or part of a payment, or may nullify in whole or part any payment previously made, to such extent as may be necessary in the Owner's opinion to protect the Owner from loss because of:

(a) Work that is defective and not remedied, or that has been demonstrated or identified as failing to conform with Applicable Laws or the Contract Documents;

(b) third party claims filed or evidence reasonably indicating that such claims will likely be filed unless security acceptable to the Owner is provided by the Contractor;

(c) failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment (in which case Owner may issue checks made payable jointly to Contractor and such unpaid persons under this provision, or directly to Subcontractors and suppliers at any level under Section C.3.2);

(d) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price;

(e) damage to the Work, Owner or Owner's agent;

(f) reasonable evidence that the Work will not be completed within the Contract Time required by the Contract, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

(g) failure to carry out the Work in accordance with the Contract Documents; or

(h) assessment of liquidated damages, when withholding is made for offset purposes.

E.2.5 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

(a) Take that portion of the Contract Price properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Price allocated to that portion of the Work in the Schedule of Values, less retainage as provided in Section E.5. Pending final determination of cost to the Owner of changes in the Work, no amounts for changes in the Work can be included in applications for payment until the Contract Price has been adjusted by a Change Order;

(b) Add that portion of the Contract Price properly allocable to materials and equipment delivered and suitably stored at the Project Site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner pursuant to Section E.2.3, suitably stored off the Project Site at a location agreed upon in writing), less retainage as provided in Section E.5;

(c) Subtract the aggregate of previous payments made by the Owner; and

(d) Subtract any amounts for which the Owner has withheld or nullified payment as provided in the Contract Documents.

E.2.6 Contractor's applications for payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier.

E.2.7 The Contractor warrants to Owner that title to all Work covered by an application for payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an application for payment all Work for which payments are received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided financing, labor, materials and equipment relating to the Work.

E.2.8 If Contractor disputes any determination by Owner with regard to any application for payment, Contractor nevertheless shall continue to expeditiously perform the Work. No payment made hereunder shall be or be construed to be final acceptance or approval of that portion of the Work to which such partial payment relates or shall relieve Contractor of any of its obligations hereunder.

E.3 PAYROLL CERTIFICATION REQUIREMENT

Owner's receipt of payroll certification pursuant to Section C.2 of the Contract shall be a condition precedent to Owner's obligation to pay any progress payments or final payment otherwise due.

E.4 DUAL PAYMENT SOURCES

Contractor shall not be compensated for Work performed under the Contract from any state agency other than the agency that is a party to the Contract.

E.5 RETAINAGE

E.5.1 Retainage shall be withheld and released in accordance with the requirements set forth in Local Contract Review Board Rules or the applicable County standard.

E.5.1.1 Owner may reserve as retainage from any progress payment an amount not to exceed five percent of the payment. As Work progresses, Owner may reduce the amount of retainage on or may eliminate retainage on any remaining monthly Contract payments after fifty (50) percent of the Work under the Contract is completed if, in the Owner's discretion, such Work is progressing satisfactorily. Elimination or reduction of retainage shall be allowed only upon written application by the Contractor, which application shall include written approval of Contractor's surety; except that when the Work is ninety-seven and a half percent (97.5%) completed in Owner's estimation, the Owner may, at its discretion and without application by the Contractor, reduce the retained amount to hundred (100) percent of the value of the Work remaining to be done. Upon receipt of written application by the Contractor, Owner shall respond in writing within a reasonable time.

E.5.1.2 If retainage is withheld, unless the Contractor requests and the Owner accepts a form of retainage described in options (a) or (b) below, the Owner (except as otherwise provided below for a contract of $500,000 or less), will deposit the retainage in an interest-bearing escrow account as required by ORS 279C.570(2). The Contractor shall execute such documentation and instructions respecting the interest-bearing escrow account as the Owner may require to protect its interests, including but not limited to a provision that no funds may be paid from the account to anyone without the Owner's advance written authorization. For a Contract over $500,000, if the Contractor requests that the Owner deposit the retainage in an interest-bearing account under ORS 279C.560(5), the Owner will use an interest-bearing escrow account as stated above. For a Contract of $500,000 or less, if the Contractor requests that the Owner deposit the retainage in an interest-bearing account under ORS 279C.560(5), the Owner will use an interest-bearing account (in a bank, savings bank, trust company or savings association) as provided under ORS 279C.450(5).

In accordance with the provisions of ORS 279C.560, Local Contract Review Board Rules, or the applicable County standard, unless the Owner finds in writing that accepting bonds, securities or other instruments described in option (a) below or a security bond described in option (b) below poses an extraordinary risk that is not typically associated with the bond, security or instrument, the Owner will approve the Contractor's written request:

a. to be paid amounts which would otherwise have been retained from progress payments where Contractor has deposited acceptable bonds, securities or other instruments of equal value with Owner or in a custodial account or other mutually-agreed account satisfactory to Owner, with an approved bank or trust company to be held in lieu of the cash retainage for the benefit of Owner. Interest or earnings on the bonds, securities or other instruments shall accrue to the Contractor. The Contractor shall execute and provide such documentation and instructions respecting the bonds, securities and other instruments as the Owner may require to protect its interests. To be permissible, the bonds, securities and other instruments must be of a character approved by Owner; or

b. that the Contractor be allowed, with the approval of the Owner, Owner allow Contractor to deposit a surety bond for the benefit of Owner, in a form acceptable to Owner, in lieu of all or a portion of funds retained, or to be retained. Such bond and any proceeds therefrom shall be made subject to all claims and liens in the manner and priority as set forth for retainage under ORS 279C.550 to ORS 279C.625.

When the Owner has accepted the Contractor's election of option (a) or (b), Owner may recover from Contractor any additional costs incurred through such election by reducing Contractor's final payment. Where the Owner has agreed to Contractor's request for option (b), Contractor shall accept like bonds from Subcontractors and suppliers on the Project from which Contractor has required retainages.

E. 5.1.3 The retainage held by Owner shall be included in and paid to the Contractor as part of the final payment of the Contract Price. The Owner shall pay to Contractor interest at the rate of two thirds of one percent per month on the final payment due Contractor, interest to commence forty-five (45) Days after the date which Owner receives Contractor's final approved application for payment and Work under the Contract has been completed and accepted and to run until the date when final payment is tendered to Contractor. The Contractor shall notify Owner in writing when the Contractor considers the Work complete and deliver to Owner its final application for payment and Owner shall, within fifteen (15) Days after receiving the written notice and the application for payment, either accept the Work or notify the Contractor of Work yet to be performed on the Contract. If Owner does not within the time allowed notify the Contractor of Work yet to be performed to fulfill contractual obligations, the interest provided by this subsection shall commence to run forty-five (45) Days after the end of the fifteen (15) Day period.

E.5.1.4 Owner will reduce the amount of the retainage if the Contractor notifies the Owner that the Contractor has deposited in an escrow account with a bank or trust company, in a manner authorized by the Owner, bonds and securities of equal value of a kind approved by the Owner and such bonds and securities have in fact been deposited.

E.5.1.5 Contractor agrees that if Contractor elects to reserve a retainage from any progress payment due to any Subcontractor or supplier, such retainage shall not exceed five percent of the payment, and such retainage withheld from Subcontractors and suppliers shall be subject to the same terms and conditions stated in Subsection E.5 as apply to Owner's retainage from any progress payment due to Contractor.

E.5.1.6 The Contractor shall comply with all applicable legal requirements for withholding and releasing retainage and for prompt payments, including but not limited to those in ORS Chapters 279C and 701, and 49 CFR 26.29.

E.6 FINAL PAYMENT

E.6.1 Upon completion of all the Work under the Contract, the Contractor shall notify the Owner, in writing, that Contractor has completed Contractor's obligations under the Contract and shall prepare its application requesting final payment. The amount of final payment will be the difference between the total amount due the Contractor pursuant to the Contract Documents and the sum of all payments previously made. Upon receipt of such notice and application for payment, the Owner will inspect the Work, and, if acceptable, submit to Contractor a recommendation as to acceptance of the completed Work and the final estimate of the amount due the Contractor. If the Work is not acceptable, Owner will notify Contractor within fifteen (15) Days of Contractor's request for final payment. Upon approval of this final application for payment by the Owner and compliance by the Contractor with

provisions in Section K, and Contractor's satisfaction of other provisions of the Contract Documents as may be applicable, the Owner shall pay to the Contractor all monies due under the provisions of these Contract Documents.

E.6.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Owner (1) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) Days' prior written notice has been given to the Owner, (2) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (3) consent of surety, if any, to final payment and (4), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien.

E.6.3 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final application for payment.

E.6.4 Contractor agrees to submit its final payment application within ninety (90) Days after Substantial Completion, unless written extension is granted by Owner. Contractor shall not delay final payment application for any reason, including without limitation nonpayment of Subcontractors, suppliers, manufacturers or others not a party to the Contract, or lack of resolution of a dispute with Owner or any other person of matters arising out of or relating to the Contract. If Contractor fails to submit its final payment application within ninety (90) Days after Substantial Completion, and Contractor has not obtained written extension by Owner, all requests or Claims for additional costs or an extension of Contract Time shall be barred.

SECTION F
PROJECT SITE CONDITIONS

F.1 USE OF PREMISES

Contractor shall confine equipment, storage of materials and operation of Work to the limits indicated by Contract Documents, Applicable Laws, permits or directions of the Owner. Contractor shall follow the Owner's instructions regarding use of premises, if any.

F.2 PROTECTION OF WORKERS, PROPERTY AND THE PUBLIC

F.2.1 Contractor shall maintain continuous and adequate protection of all of the Work from damage and shall protect the Owner, workers and property from injury or loss arising in connection with the Contract. Contractor shall remedy acceptably to the Owner any damage, injury, or loss, except such as may be directly due to errors in the Contract Documents or caused by authorized representatives or personnel of the Owner. Contractor shall adequately protect adjacent property as provided by law and the Contract Documents.

F.2.2 Contractor shall take all necessary precautions for the safety of all personnel on the Project Site or otherwise engaged in the undertaking of the Work and shall comply with the Contract Documents, best practices and all applicable provisions of federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the Work is being performed. Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for protection of workers and the public against any hazards created by construction. Contractor shall designate a responsible employee or associate on the Project Site, whose duty shall be the prevention of accidents. The name and position of the person designated shall be reported to the Owner. The Owner has no responsibility for Project Site safety. Project Site safety shall be the responsibility of the Contractor.

F.2.3 Contractor shall not enter upon private property without first obtaining permission from the property owner or its duly authorized representative. Contractor shall be responsible for the preservation of all public and private property along and adjacent to the Work contemplated under the Contract and shall use every precaution necessary to prevent damage thereto. In the event the Contractor damages any property, the Contractor shall at once notify the property owner and make, or arrange to make, full restitution. Contractor shall, immediately and in writing, report to the Owner, all pertinent facts relating to such property damage and the ultimate disposition of the claim for damage.

F.2.4 Contractor shall be responsible for protection of adjacent work areas including impacts brought about by activities, equipment, labor, utilities, vehicles and materials on the Project Site.

F.2.5 Contractor shall at all times direct its activities in such a manner as to minimize adverse effects on the environment. Handling of all materials shall be conducted so no release will occur that may pollute or become hazardous.

F.2.6 In an emergency affecting the safety of life or limb or of the Work or of adjoining property, the Contractor, without special instruction or authorization from the Owner, shall act reasonably to prevent threatened loss or injury, and shall so act, without appeal, if instructed by the Owner. Any compensation claimed by the Contractor on account of emergency work shall be determined in accordance with section D.

F.2.7 Contractor shall comply with all Owner safety rules and regulations, if applicable. Prior to commencement of any Work, Contractor and Subcontractors shall be required to complete an Owner Contractor Safety Orientation and submit all Owner required safety plans.

F.2.8 Contractor shall demonstrate that an employee drug testing program is in place.

F.3 CUTTING AND PATCHING

F.3.1 If applicable, Contractor shall be responsible for coordinating all cutting, fitting, or patching of the Work to make its several parts come together properly and fit to receive or be received by work of other contractors or Subcontractors shown upon, or reasonably implied by, the Contract Documents.

F.3.2 If applicable, Contractor shall be responsible for restoring all cut, fitted, or patched surfaces to an original condition; provided, however, that if a different condition is specified in the Contract Documents, then Contractor shall be responsible for restoring such surfaces to the condition specified in the Contract Documents.

F.4 CLEANING UP

From time to time as may be prudent or ordered by the Owner and, in any event, immediately after completion of the Work, the Contractor shall, at its own expense, clean up and remove all refuse and unused materials of any kind resulting from the Work. If Contractor fails to do so within twenty-four (24) hours after notification by the Owner the work may be

done by others and the cost charged to the Contractor and deducted from payment due the Contractor.

F.5 ENVIRONMENTAL CONTAMINATION

F.5.1. Contractor shall be held responsible for and shall indemnify, defend (with counsel of Owner's choice), and hold harmless Owner from and against any costs, expenses, damages, claims, and causes of action, or any of them, resulting from all spills, releases, discharges, leaks and disposal of environmental pollution, including storage, transportation, and handling during the performance of the Work or Contractor's obligations under the Contract which occur as a result of, or are contributed by, the negligence or actions of Contractor or its personnel, agents, or Subcontractors or any failure to perform in accordance with the Contract Documents (except to the extent otherwise void under ORS 30.140). Nothing in this section F.5.1 shall limit Contractor's responsibility for obtaining insurance coverages required under Section G.3 of the Contract, and Contractor shall take no action that would void or impair such coverages.

F.5.1.1 Contractor agrees to promptly dispose of such spills, releases, discharge or leaks to the satisfaction of Owner and regulatory agencies having jurisdiction in a manner that complies with Applicable Laws. Cleanup shall be at no cost to the Owner and shall be performed by properly qualified and, if applicable, licensed personnel.

F.5.1.2 Unless otherwise approved in the Solicitation Document, Contractor shall obtain the Owner's written consent prior to bringing onto the Project Site any (i) environmental pollutants or (ii) hazardous substances or materials, as the same or reasonably similar terms are used in any Applicable Laws. In any event, Contractor shall provide prior written notice to Owner when hazardous materials are brought on to the Project Site. The Contractor, at all times, shall:

(a) properly handle, use and dispose of all environmental pollutants and hazardous substances or materials on the Project Site, in accordance with all Applicable Laws;

(b) be responsible for any and all spills, releases, discharges, or leaks of (or from) environmental pollutants or hazardous substances or materials which Contractor has brought onto the Project Site; and

(c) promptly clean up and remediate, without cost to the Owner, such spills, releases, discharges, or leaks to the Owner's satisfaction and in compliance with all Applicable Laws.

F.5.2 Contractor shall report all reportable quantity releases, as such releases are defined in Applicable Laws. Upon discovery, regardless of quantity, Contractor must verbally report all releases to the Owner in a prompt manner. A written follow-up report shall be submitted to Owner within 48 hours of the telephonic report. Such written report shall contain, as a minimum:

(a) Description of items released (identity, quantity, manifest numbers, and any and all other documentation required by law).

(b) Whether amount of items released is EPA/DEQ reportable, and, if so, when reported.

(c) Exact time and location of release, including a description of the area involved.

(d) Containment procedures initiated.

(e) Summary of communications about the release between Contractor and State, local or federal officials other than Owner. Any communication to the press will be done by Owner and Contractor will defer to Owner.

(f) Description of cleanup procedures employed or to be employed at the Project Site, including disposal location of spill residue.

(g) Personal injuries, if any, resulting from, or aggravated by, the release.

F.6 ENVIRONMENTAL CLEAN-UP

F.6.1 Unless disposition of environmental pollution is specifically a part of the Contract, or was caused by the Contractor (reference F.5 Environmental Contamination), Contractor shall immediately notify Owner of any hazardous substance(s) which Contractor discovers or encounters during performance of the Work required by the Contract. "Hazardous substance(s)" means any hazardous, toxic and radioactive materials and those substances defined as "hazardous substances," "hazardous materials," "hazardous wastes," "toxic substances," or other similar designations in any federal, state, or local law, regulation, or ordinance, including without limitation asbestos, polychlorinated biphenyl ("PCB"), or petroleum, and any substances, materials or wastes regulated by 40 CFR, Part 261 and defined as hazardous in 40 CFR S 261.3. In addition to notifying Owner of any hazardous substance(s) discovered or encountered, Contractor shall immediately cease working in any particular area of the Project where a hazardous substance(s) has been discovered or encountered if continued work in such area would present a risk or danger to the health or wellbeing of Contractor's or any Subcontractor's work force, property or the environment.

F.6.2 Upon being notified by Contractor of the presence of hazardous substance(s) on the Project Site, not brought on to the Project Site by Contactor, Owner shall arrange for the proper disposition of such hazardous substance(s).

F.7 DEMOLITION

F.7.1 For demolition tasks, if any, the Contractor shall salvage or recycle construction and demolition debris, if feasible and cost-effective.

SECTION G
INDEMNITY, BONDING, AND INSURANCE

G.1 RESPONSIBILITY FOR DAMAGES / INDEMNITY

G.1.1 Contractor shall be responsible for all damage to property, injury to persons, and loss, expense, inconvenience, and delay that may be caused by, or result from, the carrying out of the Work to be done under the Contract, or from any act, omission or neglect of the Contractor, its Subcontractors, employees, guests, visitors, invitees and agents.

G.1.2 To the fullest extent permitted by law, Contractor shall indemnify, defend (with counsel approved by Owner) and hold harmless the Owner and its elected officials, officers, directors, agents, and employees (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses, demands and actions of any nature whatsoever which arise out of, result from or are related to: (a) any damage, injury, loss, expense, inconvenience or delay described in this Section G.1; (b) any accident or occurrence which happens or is alleged to have happened in or about the Project Site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects; (c) any failure of the Contractor to

observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor contained in the Contract Documents or in any subcontract; (d) the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or any one of them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder (except to the extent otherwise void under ORS 30.140); and (e) any lien filed upon the Project or bond claim in connection with the Work. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section G.1.2.

G.1.3 In claims against any person or entity indemnified under Section G.1.2 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section G.1.2 shall not be limited on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

G.2 PERFORMANCE AND PAYMENT SECURITY; PUBLIC WORKS BOND

G.2.1 When the Contract Price is $50,000 or more, the Contractor shall furnish and maintain in effect at all times during the Contract Period a performance bond in a sum equal to the Contract Price and a separate payment bond also in a sum equal to the Contract Price. Contractor shall furnish such bonds even if the Contract Price is less than the above thresholds if otherwise required by the Contract Documents.

G.2.2 Bond forms furnished by the Owner and notarized by Contractor's surety company authorized to do business in Oregon are the only acceptable forms of performance and payment security, unless otherwise specified in the Contract Documents.

G.2.3 Before execution of the Contract, the Contractor shall file with the Construction Contractors Board, and maintain in full force and effect, the separate public works bond required by Oregon Revised Statutes, Chapter 279C.830 and 279C.836, unless otherwise exempt under those provisions. The Contractor shall also include in every subcontract a provision requiring the Subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work, unless otherwise exempt, and shall verify that the Subcontractor has filed a public works bond before permitting any Subcontractor to start Work.

G.3 INSURANCE

G.3.1 Primary Coverage: Insurance carried by Contractor under the Contract shall be the primary coverage. The coverages indicated are minimums unless otherwise specified in the Contract Documents.

G.3.2 Workers' Compensation: All employers, including Contractor, that employ subject workers who work under the Contract in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. This shall include Employer's Liability Insurance with coverage limits of not less than the minimum amount required by statute for each accident. Contractors who perform the Work without the assistance or labor of any employee need not obtain such coverage if the Contractor certifies so in writing. Contractor shall ensure that each of its Subcontractors complies with these requirements. The Contractor shall require proof of such Workers' Compensation coverage by receiving and keeping on file a certificate of insurance from each Subcontractor or anyone else directly employed by either the Contractor or its Subcontractors.

G.3.3 Builder's Risk Insurance:

G.3.3.1 Builder's Risk: During the term of the Contract, for new construction the Contractor shall obtain and keep in effect Builder's Risk insurance on an all risk forms, including earthquake and flood, for an amount equal to the full amount of the Contract, plus any changes in values due to modifications, Change Orders and loss of materials added. Such Builder's Risk shall include, in addition to earthquake and flood, theft, vandalism, mischief, collapse, transit, debris removal, and architect's fees "soft costs" associated with delay of Project due to insured peril. Any deductible shall not exceed $50,000 for each loss, except the earthquake and flood deductible which shall not exceed 2 percent of each loss or $50,000, whichever is greater. The deductible shall be paid by Contractor. The policy will include as loss payees Owner, the Contractor and its Subcontractors as their interests may appear.

G.3.3.2 Builder's Risk Installation Floater: For Work other than new construction, Contractor shall obtain and keep in effect during the term of the Contract, a Builder's Risk Installation Floater for coverage of the Contractor's labor, materials and equipment to be used for completion of the Work performed under the Contract. The minimum amount of coverage to be carried shall be equal to the full amount of the Contract. The policy will include as loss payees Owner, the Contractor and its Subcontractors as their interests may appear. Owner may waive this requirement at its sole and absolute discretion.

G.3.3.3 Such insurance shall be maintained until Owner has occupied the facility.

G.3.3.4 A loss insured under the Builder's Risk insurance shall be adjusted by the Owner and made payable to the Owner as loss payee. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner. The Owner shall have power to adjust and settle a loss with insurers.

G.3.4 General Liability Insurance:

G.3.4.1 Commercial General Liability: Upon execution of a Contract, Contractor shall obtain, and keep in effect at Contractor's expense for the term of the Contract, Commercial General Liability Insurance ("CGL") covering bodily injury and property damage in the amount of not less than $1,000,000 per claim and $2,000,000 per occurrence in a form satisfactory to Owner. This insurance shall include personal injury liability, products and completed operations, and contractual liability coverage for the indemnities provided under the Contract (to the extent contractual liability coverage for the indemnity is available in the marketplace), and shall be issued on an occurrence basis written on ISO Form GC 00 01 (12 04 or later) or an equivalent form approved in advance by Owner. The CGL shall provide separation of insured language. The policy or policies obtained by Contractor for purposes of fulfilling the requirements of this section shall be primary insurance with respect to the Owner. Any insurance or self-insurance maintained by the County shall be excess and shall not contribute to it.

G.3.4.2 Automobile Liability: Contractor shall obtain, at Contractor's expense, and keep in effect during the term of the Contract, Automobile Liability Insurance covering owned, and/or hired vehicles, as applicable. The coverage may be written in combination with the Commercial General Liability Insurance. Contractor shall provide proof of insurance of not less than $1,000,000 per claim and $2,000,000 per occurrence. Contractor

and its Subcontractors shall be responsible for ensuring that all non-owned vehicles maintain adequate Automobile Liability insurance while on Project Site.

G.3.4.3 Owner may adjust the insurance amounts required in Section G.3.4.1 and G.3.4.2 based upon institution specific risk assessments through the issuance of Supplemental General Conditions and a Contract.

G.3.4.4 To the extent that the Contract Documents require the Contractor to provide professional design services, design-build, or certifications related to systems, materials, or equipment, the Contractor shall (1) purchase and maintain professional liability/errors-and-omissions insurance with limits of not less than $1,000,000 for each claim and $2,000,000 general annual aggregate and (2) cause those Subcontractors (of any tier) who are providing professional design services including any design-build services to procure and maintain professional liability/errors-and-omissions insurance with limits of not less than $1,000,000 for each claim and $2,000,000 general annual aggregate. This policy shall be for the protection of the Owner, its elected officials, officers, agents and employees against liability for damages because of personal injury, bodily injury, death, or damage to property, including loss of use thereof, and damages because of negligent acts, errors and omissions in any way related to the Contract. The Owner, at its option, may require a complete copy of the above policy.

G.3.4.5 "Tail" Coverage: If any of the required liability insurance is arranged on a "claims made" basis, "tail" coverage will be required at the completion of the Contract for a duration of 36 months or the maximum time period available in the marketplace if less than 36 months. Contractor shall furnish certification of "tail" coverage as described or continuous "claims made" liability coverage for 36 months following Final Completion. Continuous "claims made" coverage will be acceptable in lieu of "tail" coverage, provided its retroactive date is on or before the effective date of the Contract. Owner's receipt of the policy endorsement evidencing such coverage shall be a condition precedent to Owner's obligation to make final payment and to Owner's final acceptance of Work or services and related warranty (if any).

G.3.4.6 Umbrella Liability (if required by Owner through issuance of Supplemental General Conditions): Contractor shall obtain, at Contractor's expense, and keep in effect during the term of the Contract, Umbrella liability Insurance over and above the general liability, automobile liability and workers' compensation coverage if required by Owner in specified limits at time of requirement.

G.3.4.7 Pollution Liability may be required by Owner through issuance of Supplemental General Conditions.

G.3.5 Additional Insured: The general liability insurance coverage, automobile liability, umbrella, and pollution liability if required, shall include the Owner as additional insureds but only with respect to the Contractor's activities to be performed under the Contract. The additional-insured endorsement for CGL insurance must be written on ISO Form CG 20 10 (10 01) and CG 20 37 (10 01), or their equivalent, but shall not use either of the following forms: CG 20 10 (10 93) or CG 20 10 (03 94). Proof of insurance must include a copy of the endorsement showing "Clackamas County, its elected officials, agents, officers, and employees" as scheduled insureds.

If Contractor cannot obtain an insurer to name the Owner as additional insureds, Contractor shall obtain at Contractor's expense, and keep in effect during the term of the Contract, Owners and Contractors Protective Liability Insurance, naming the Owner as additional insureds with not less than a $2,000,000 limit per occurrence. This policy must be kept in effect for 36 months following Final Completion. As evidence of coverage, Contractor shall furnish the actual policy to Owner prior to execution of the Contract.

G.3.6 Notice of Cancellation or Change: If the Contractor receives a non-renewal or cancellation notice from an insurance carrier affording coverage required herein, or receives notice that coverage no longer complies with the insurance requirements herein, Contractor agrees to notify Owner by fax within five (5) business days with a copy of the non-renewal or cancellation notice, or written specifics as to which coverage is no longer in compliance. When notified by Owner, the Contractor agrees to stop Work pursuant to the Contract at Contractor's expense, unless all required insurance remain in effect. Any failure to comply with the reporting provisions of this insurance, except for the potential exhaustion of aggregate limits, shall not affect the coverages provided to the Owner and its institutions, divisions, officers, and employees.

Owner shall have the right, but not the obligation, of prohibiting Contractor from entering the Project Site until a new certificate(s) of insurance is provided to Owner evidencing the replacement coverage. The Contractor agrees that Owner reserves the right to withhold payment to Contractor until evidence of reinstated or replacement coverage is provided to Owner.

G.3.7 Certificate(s) of Insurance/Insurance Carrier Qualification: As evidence of the insurance coverage required by the Contract, the Contractor shall furnish certificate(s) of insurance to the Owner prior to execution of the Contract. The certificate(s) will specify all of the parties who are additional insureds or loss payees for the Contract. A renewal certificate shall be sent to Owner at least 10 days prior to coverage expiration. Insurance coverage required under the Contract shall be obtained from insurance companies or entities acceptable to the Owner and that are eligible to provide such insurance under Oregon law. Eligible insurers include admitted insurers that have been issued a certificate of authority from the Oregon Department of Consumer and Business Services authorizing them to conduct an insurance business and issue policies of insurance in the state of Oregon, and certain non-admitted surplus lines insurers that satisfy the requirements of applicable Oregon law and which are subject to approval by the Owner. The Contractor shall be financially responsible for all deductibles, self-insured retentions and/or self-insurance included hereunder. Any deductible, self-insured retention and/or self-insurance in excess of $50,000 shall be subject to approval by the Owner in writing and shall be a condition precedent to the effectiveness of any Contract.

SECTION H
SCHEDULE OF WORK

H.1 CONTRACT PERIOD

H.1.1 Time is of the essence. The Contractor shall at all times carry on the Work diligently, without delay and punctually fulfill all requirements herein.

H.1.2 Notice to Proceed. Unless otherwise directed in the Contract Documents, Contractor shall commence Work on the Project Site within fifteen (15) Days of the Notice to Proceed. Notwithstanding the Notice to Proceed, Contractor shall not be authorized to proceed with the Work until all initial Contract requirements, including the Contract, performance bond and payment bond, and certificates of insurance, have been fully executed and submitted in a form acceptable to Owner.

H.1.3 Unless otherwise not required in the Construction Documents, Contractor shall participate in a pre-construction conference with the Owner's representative and designated design team. The

purpose of this pre-construction conference is to review the Contractor's proposed Schedule of Values and to review any other Project logistics to be coordinated between the parties.

H.1.4 Unless specifically extended by a Change Order, all Work shall be complete by the date contained in the Contract Documents. The Owner shall have the right to accelerate the completion date of the Work, which may require the use of overtime. Such accelerated Work schedule shall be an acceleration in performance of Work under Section D.1.2(f) and shall be subject to the provisions of Section D.1.

H.1.5 The Owner shall not waive any rights under the Contract by permitting the Contractor to continue or complete in whole or in part the Work after the date described in Section H.1.2 above.

H.2 SCHEDULE

H.2.1 Contractor shall provide, by or before the pre-construction conference, the initial as-planned schedule for review and acceptance by the Owner. The submitted schedule must illustrate Work by Project components, labor trades, and long lead items broken down by building and/or floor where applicable. If Owner shall so elect, Contractor shall provide the schedule in CPM format showing the graphical network of planned activities, including i) a reasonably detailed list of all activities required to complete the Work; ii) the time and duration that each activity will take to completion; and iii) the dependencies between the activities. Schedules lacking adequate detail, or unreasonably detailed, will be rejected. The schedule shall include the following: Notice to Proceed or the date the Work commences, if no Notice to Proceed is issued by Owner, Substantial Completion, and Final Completion. Schedules shall be updated monthly, unless otherwise required by the Contract Documents, and submitted with the monthly application for payment. Acceptance of the Schedule by the Owner does not constitute agreement by the Owner as to the Contractor's sequencing, means, methods, or durations. Any positive difference between the Contractor's scheduled completion and the Contract completion date is float owned by the Owner. Owner reserves the right to negotiate the float if it is deemed to be in Owner's best interest to do so. In no case shall the Contractor make a claim for delays if the Work is completed within the Contract Time but after Contractor's scheduled completion.

H.2.2 All Work shall be completed during normal weekdays (Monday through Friday) between the hours of 7:00 a.m. and 5:00 p.m. unless otherwise specified in the Contract Documents. Unless otherwise specified in the Contract Documents, no Work shall be performed during the following holidays:

- New Year's Day
- Martin Luther King Day
- Memorial Day
- Independence Day
- Labor Day
- Veterans Day
- Thanksgiving Day
- Christmas Day
- President's Day

When a holiday falls on a Sunday, the following Monday shall be recognized as a legal holiday. When a holiday falls on Saturday, the preceding Friday shall be recognized as a legal holiday.

H.3 PARTIAL OCCUPANCY OR USE

The Owner may occupy or use any completed or partially completed portion of the Work at any stage, provided such occupancy or use is consented to by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have reasonably accepted in writing the responsibilities assigned to each of them. Approval by the Contractor to partial occupancy or use shall not be unreasonably withheld. Immediately prior to such partial occupancy or use, the Owner and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

SECTION I
CORRECTION OF WORK

I.1 CORRECTION OF WORK BEFORE FINAL PAYMENT

The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects, and that the Work will conform to the requirements of the Contract Documents. Work failing to conform to these requirements shall be deemed defective. Contractor shall promptly remove from the premises and replace all defective materials and equipment as determined by the Owner, whether incorporated in the Work or not. Removal and replacement shall be without loss or expense to the Owner, and Contractor shall bear the cost of repairing all Work destroyed or damaged by such removal or replacement. Contractor shall be allowed a period of no longer than thirty (30) Days after Substantial Completion for completion of defective (Punch List) work. At the end of the thirty-day period, or earlier if requested by the Contractor, Owner shall arrange for inspection of the Work by the Architect/Engineer. Should the work not be complete, and all corrections made, the costs for all subsequent reinspections shall be borne by the Contractor. If Contractor fails to complete the Punch List work within the thirty (30) Day period, Owner may perform such work and Contractor shall reimburse Owner all costs of the same within ten (10) Days after demand without affecting Contractor's obligations.

I.2 WARRANTY WORK

I.2.1 Neither the final certificate of payment nor any provision of the Contract Documents shall relieve the Contractor from responsibility for Defective Work and, unless a longer period is specified, Contractor shall correct all defects that appear in the Work within a period of one year from the date of issuance of the written notice of Substantial Completion by the Owner except for latent defects which will be remedied by the Contractor at any time they become apparent. The Owner shall give Contractor notice of defects with reasonable promptness. Contractor shall perform such warranty work within a reasonable time after Owner's demand and at Contractors sole expense. If Contractor fails to complete the warranty work within such period as Owner determines reasonable, or at any time in the event of warranty work consisting of emergency repairs, Owner may perform such work and Contractor shall reimburse Owner all costs of the same within ten (10) Days after demand, without affecting Contractor's obligations. The Contractor shall perform the warranty Work by correcting defects within twenty-four (24) hours of notification by Owner, unless otherwise specified in the Contract Documents. Should the Contractor fail to respond within the specified response time, the Owner may, at its option, complete the necessary repairs using another contractor or its agents. If Owner completes the repairs using Owner's agent, Contractor shall pay Owner at the rate of one and one-half (1½) times the standard hourly rate of Owner's agent, plus related overhead and any direct non-salary costs. If Owner completes the repairs using another contractor, Contractor shall pay Owner the amount of Owner's direct costs billed by the other contractor for the work, plus the direct salary costs and related overhead and direct non-salary expenses of Owner's agents who

are required to monitor that contractor's work. Work performed by Owner using Owner's own agents or those of another contractor shall not affect the Contractor's contractual duties under these provisions, including warranty provisions.

I.2.2 Nothing in this Section I.2 provision shall negate guarantees or warranties for periods longer than one year including without limitation, such guarantees or warranties required by other sections of the Contract Documents for specific installations, materials, processes, equipment or fixtures.

I.2.3 In addition to Contractor's warranty, manufacturer's warranties shall pass to the Owner and shall not take effect until such portion of the Work covered by the applicable warranty has been accepted in writing by the Owner.

I.2.4 The one-year period for correction of Work shall be extended with respect to portions of Work performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work, and shall be extended by corrective Work performed by the Contractor pursuant to this Section, as to the Work corrected. The Contractor shall remove from the Project Site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

I.2.5 Nothing contained in this Section I.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the period for correction of Work as described in this Section I.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

I.2.6 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Price will be reduced as appropriate and equitable as determined by Owner. Such adjustment shall be effected whether or not final payment has been made.

SECTION J
SUSPENSION AND/OR TERMINATION OF THE WORK

J.1 OWNER'S RIGHT TO SUSPEND THE WORK

J.1.1 The Owner has the authority to suspend portions or all of the Work due to the following causes:

(a) Failure of the Contractor to correct unsafe conditions;

(b) Failure of the Contractor to carry out any provision of the Contract;

(c) Failure of the Contractor to carry out orders;

(d) Conditions, in the opinion of the Owner, which are unsuitable for performing the Work;

(e) Time required to investigate differing Project Site conditions; or

(f) Any reason considered to be in the public interest.

J.1.2 The Owner shall notify Contractor and the Contractor's Surety in writing of the effective date and time of the suspension, and Owner shall notify Contractor and Contractor's surety in writing to resume Work.

J.2 CONTRACTOR'S RESPONSIBILITIES

J.2.1 During the period of the suspension, Contractor is responsible to continue maintenance at the Project just as if the Work were in progress. This includes, but is not limited to, protection of completed Work, maintenance of access, protection of stored materials, temporary facilities, and clean-up.

J.2.2 When the Work is recommenced after the suspension, the Contractor shall replace or renew any Work damaged during the suspension, remove any materials or facilities used as part of temporary maintenance, and complete the Work in every respect as though its prosecution had been continuous and without suspension.

J.3 COMPENSATION FOR SUSPENSION

Depending on the reason for suspension of the Work, the Contractor or the Owner may be due compensation by the other party. If the suspension was required due to acts or omissions of Contractor, the Owner may assess the Contractor actual costs of the suspension in terms of administration, remedial work by the Owner's agents or another contractor to correct the problem associated with the suspension, rent of temporary facilities, and other actual costs related to the suspension, and any liquidated damages arising from the delay. If the suspension was caused by acts or omissions of the Owner, the Contractor may be due compensation which shall be defined using Section D, Changes in Work. If the suspension was required through no fault of the Contractor or the Owner, neither party shall owe the other for the impact.

J.4 OWNER'S RIGHT TO TERMINATE CONTRACT

J.4.1 The Owner may, without prejudice to any other right or remedy, and after giving Contractor seven (7) Days' written notice and an opportunity to cure, terminate the Contract in whole or in part under the following conditions:

(a) If Contractor should, voluntarily or involuntarily, seek protection under the United States Bankruptcy Code and Contractor as debtor-in-possession or the Trustee for the estate fails to assume the Contract within a reasonable time;

(b) If Contractor should make a general assignment for the benefit of Contractor's creditors;

(c) If a receiver should be appointed on account of Contractor's insolvency;

(d) If Contractor should repeatedly refuse or fail to supply an adequate number of skilled workers or proper materials to carry on the Work as required by the Contract Documents, or otherwise fail to perform the Work in a timely manner;

(e) If Contractor should repeatedly fail to make prompt payment to Subcontractors or for material or labor, or should disregard laws, ordinances or the instructions of the Owner;

(f) If Contractor is otherwise in breach of any part of the Contract; or

(g) If Contractor is in violation of Applicable Laws, either in the conduct of its business or in its performance of the Work.

J.4.2 At any time that any of the above occurs, Owner may exercise all rights and remedies available to Owner at law or in equity, and, in addition, Owner may take possession of the premises and of all materials and appliances and finish the Work by whatever method it may deem expedient. In such case, the Contractor shall not be entitled to receive further payment until the Work is completed. If

the Owner's cost of finishing the Work exceeds the unpaid balance of the Contract Price, Contractor shall pay the difference to the Owner.

J.5 TERMINATION FOR CONVENIENCE, NON-APPROPRIATION OF FUNDS, OR FORCE MAJEURE

J.5.1 Owner may terminate the Contract in whole or in part whenever Owner determines: (a) that termination of the Contract is in the best interest of Owner or the public; (b) that the Owner failed to receive funding, appropriations, allocations or other expenditure authority as contemplated by Owner's budget and Owner determines, in its sole determination, and its assessment and ranking of the policy objectives explicit or implicit in Owner's budget, Owner may determine it is necessary to and may terminate the Contract.; or (c) in the event of Force Majeure.

J.5.2 The Owner shall provide the Contractor with seven (7) Days prior written notice of a termination for Owner's or for public convenience. After such notice, the Contractor shall provide the Owner with immediate and peaceful possession of the premises and materials located on and off the premises for which the Contractor received progress payment under Section E. Compensation for Work terminated by the Owner under this provision will be according to Section E. In no circumstance shall Contractor be entitled to lost profits for Work not performed due to termination. If the Contract is terminated for public convenience, neither the Contractor not its Surety shall be relieved of liability for damages or losses suffered by the Owner as a result of defective, unacceptable or unauthorized Work completed or performed.

J.6 ACTION UPON TERMINATION

J.6.1 Upon receiving a notice of termination, and except as directed otherwise by the Owner, Contractor shall immediately cease placing further subcontracts or orders for materials, services, or facilities. In addition, Contractor shall terminate all subcontracts or orders to the extent they relate to the Work terminated and, with the prior written approval of the Owner, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts and orders.

J.6.2 As directed by the Owner, Contractor shall, upon termination, transfer title and deliver to the Owner all Record Documents, information, and other property that, if the Contract had been completed, would have been required to be furnished to the Owner.

J.6.3 Upon Owner's notice of termination pursuant to either Section J.4 or J.5, if Owner shall so elect, Contractor shall assign to the Owner such subcontracts and orders as Owner shall specify. In the event Owner elects to take assignment of any such subcontract or order, Contractor shall take such action and shall execute such documents as Owner shall reasonably require for the effectiveness of such assignment and Contractor shall ensure that no contractual arrangement between it and its subcontractors or suppliers of any tier or sub-tier shall prevent such assignment.

SECTION K
CONTRACT CLOSE OUT

K.1 RECORD DOCUMENTS

As a condition of final payment (refer also to section E.6), Contractor shall comply with the following: Contractor shall provide Record Documents for the entire Project to Owner. Record Documents shall depict the Project as constructed and shall reflect each and every change, modification, and deletion made during the construction. Record Documents are part of the Work and shall be provided prior to the Owner's issuance of final payment. Record Documents include all modifications to the Contract Documents unless otherwise directed.

K.2 OPERATION AND MAINTENANCE MANUALS

As part of the Work, Contractor shall submit two completed operation and maintenance manuals ("O & M Manuals") for review by the Owner prior to submission of any pay request for more than 75% of the Work. Owner's receipt of the O & M Manuals shall be a condition precedent to any payment thereafter due. The O & M Manuals shall contain a complete set of all submittals, all product data as required by the specifications, training information, telephone list and contact information for all consultants, manufacturers, installer and suppliers, manufacturer's printed data, record and shop drawings, schematic diagrams of systems, appropriate equipment indices, warranties and bonds. The Owner shall review and return one O & M Manual for any modifications or adjustments required. Prior to submission of its final pay request, Contractor shall deliver two (2) complete and approved sets of O & M Manuals in paper form and one (1) complete and approved set in electronic form to the Owner and Owner's receipt of the O & M Manuals shall be a condition precedent to Owner's obligation to make final payment.

K.3 COMPLETION NOTICES

K.3.1 Contractor shall provide Owner written notice of both Substantial and Final Completion. The certificate of Substantial Completion shall state the date of Substantial Completion, the responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and the time within which the Contractor shall finish all items on the Punch List accompanying the Certificate. Both completion notices must be signed and notarized by the Contractor and signed by the Architect/Engineer (if applicable) and Owner to be valid. The Owner shall provide the final signature on the notices. The notices shall take effect on the date they are signed by the Owner.

K.3.2 Substantial Completion of a facility with operating systems (e.g., mechanical, electrical, HVAC) shall be that degree of completion that has provided a minimum of thirty (30) continuous Days of successful, trouble-free operation, which period shall begin after all performance and acceptance testing has been successfully demonstrated to the Owner. All equipment contained in the Work, plus all other components necessary to enable the Owner to operate the facility in the manner that was intended, shall be complete on the Substantial Completion date. The Contractor may request that a Punch List be prepared by the Owner with submission of the request for the Substantial Completion notice.

K.4 TRAINING

As part of the Work, and prior to submission of the final application for payment, the Contractor shall schedule with the Owner training sessions for all equipment and systems as required by the Contract Documents. Contractor shall schedule training sessions at least two weeks in advance of the date of training to allow Owner to provide its personnel with adequate notice. If assignments arise because of termination under Section J.4, then such assignments shall not relieve Contractor of liability hereunder. The O & M Manual shall be used as a basis for training. In addition to any off-Project Site training required by the Contract Documents, training shall include a formal session conducted at the Project Site after the equipment and/or system is completely installed and operational in its normal operating environment.

K.5 EXTRA MATERIALS

As part of the Work, Contractor shall provide spare parts, extra maintenance materials, and other materials or products in the quantities specified in the Contract Documents prior to final payment. Delivery point for extra materials shall be designated by the Owner.

K.6 ENVIRONMENTAL CLEAN-UP

As part of the Final Completion notice, or as a separate written notice submitted with or before the notice of Final Completion, the Contractor shall notify the Owner that all environmental and pollution clean-up, remediation and closure have been completed in accordance with all Applicable Laws and pursuant to the authority of all agencies having jurisdiction, and Contractor shall provide Owner with any and all documentation related to the same, including but not limited to directives, orders, letters, certificates and permits related to or arising from such environmental pollution. The notice shall reaffirm the indemnification given under Section F.5.1 above. Contractor's completion of its obligations under this Section K.6 and Owner's receipt of documents evidencing such completion shall be a condition precedent to Owner's obligation to make final payment.

K.7 CERTIFICATE OF OCCUPANCY

Owner's receipt of an unconditioned certificate of occupancy from the appropriate state and/or local building officials shall be a condition precedent to Owner's obligation to make final payment, except to the extent failure to obtain an unconditional certificate of occupancy is due to the fault or neglect of Owner.

K.8 OTHER CONTRACTOR RESPONSIBILITIES

The Contractor shall be responsible for returning to the Owner all property of Owner issued to Contractor during construction such as keys, security passes, Project Site admittance badges, and all other pertinent items. Upon notice from Owner, Contractor shall be responsible for notifying the appropriate utility companies to transfer utility charges from the Contractor to the Owner. The utility transfer date shall not be before Substantial Completion and may not be until Final Completion, if the Owner does not take beneficial use of the facility and the Contractor's agents continue with the Work.

The Owner's property is drug free and weapons free areas and the use of tobacco products is only allowed in designated areas. Contractor shall be required to ensure that its employees, Subcontractors and agents shall comply with these requirements.

SECTION L
GENERAL PROVISIONS

L.1 NO THIRD PARTY BENEFICIARIES

Owner and Contractor are the only parties to the Contract and are the only parties entitled to enforce its terms. Nothing in the Contract gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of the terms of the Contract.

L.2 SEVERABILITY

If any provision of the Contract is declared by a court to be unenforceable, illegal, or in conflict with any law, the validity of the remaining terms and provisions shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

L.3 ACCESS TO RECORDS

L.3.1 Contractor shall keep, at all times on the Project Site, one record copy of the complete Contract Documents, including the Plans, Specifications, addenda, and Change Orders (if any) in good order and marked currently to record field changes and selections made during construction, and one record copy of Shop Drawings, Product Data, Samples and similar submittals, and shall at all times give the Owner access thereto.

L.3.2 Contractor shall retain and the Owner and its duly authorized representatives shall have access, for a period not less than ten (10) years, to all Record Documents, financial and accounting records, and other books, documents, papers and records of Contractor which are pertinent to the Contract, including records pertaining to Overhead and indirect costs, for the purpose of making audit, examination, excerpts and transcripts. If for any reason, any part of the Work or the Contract shall be subject to litigation, Contractor shall retain all such records until all litigation is resolved and Contractor shall continue to provide Owner and/or its agents with full access to such records until such time as all litigation is complete and all periods for appeal have expired and full and final satisfaction of any judgment, order or decree is recorded and Owner receives a record copy of documentation from Contractor.

L.4 WAIVER

Failure of the Owner to enforce any provision of the Contract shall not constitute a waiver or relinquishment by the Owner of the right to such performance in the future nor of the right to enforce any other provision of the Contract.

L.5 SUCCESSORS IN INTEREST

The provisions of the Contract shall be binding upon and shall accrue to the benefit of the parties to the Contract and their respective permitted successors and assigns.

L.6 GOVERNING LAW

The Contract shall be governed by and construed in accordance with the laws of the State of Oregon without giving effect to the conflict of law provisions thereof.

L.7 APPLICABLE LAW

Contractor hereto agrees to comply in all ways with applicable local, state and federal ordinances, statutes, laws and regulations.

L.8 NON-EXCLUSIVE RIGHTS AND REMEDIES

Except as otherwise expressly provided herein, the rights and remedies expressly afforded under the provisions of the Contract shall not be deemed exclusive, and shall be in addition to and cumulative with any and all rights and remedies otherwise available at law or in equity. The exercise by either Party of any one or more of such remedies shall not preclude the exercise by it, at the same or different times, of any other remedies for the same default or breach, or for any other default or breach, by the other Party.

L.9 INTERPRETATION

The titles of the sections of the Contract are inserted for convenience of reference only and shall be disregarded in construing or interpreting any of its provisions.

L.10 DEBT LIMITATION

The Contract is expressly subject to the debt limitation of Oregon counties set forth in Article XI, Section 10, of the Oregon Constitution, and is contingent upon funds being appropriated therefore. Any provisions herein which would conflict with law are deemed inoperative to that extent.

L.11 LITIGATION

Any Claim between Owner and Contractor that arises from or relates to the Contract and that is not resolved through the Claims Review Process in Section D.3 shall be brought and conducted solely and exclusively within the Circuit Court of Clackamas County for the State of Oregon; provided, however, if a Claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by the County of any form of defense or

immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR, BY EXECUTION OF THE CONTRACT, HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION.

L. 12 SURVIVAL

All warranty, indemnification, and record retention provisions of the Contract, and all of Contractor's other obligations under the Contract that are not fully performed by the time of Final Completion or termination, and all other rights and obligations which by their context are intended to survive, shall survive Final Completion or any termination of the Contract.

L.13 ACCESS TO RECORDS

L.13.1. Contractor shall keep, at all times on the Work site, one record copy of the complete Contract Documents, including the Plans, Specifications, Construction Change Directives and addenda, in good order and marked currently to record field changes and selections made during construction, and one copy of Shop Drawings, Project Data, Samples and similar submittals, and shall at all times give the Owner access thereto.

L.13.2 Contractor shall retain and the Owner and its duly authorized representatives shall have access, for a period not less than ten (10) years, to all Record Documents, financial and accounting records, and other books, documents, papers and records of Contractor which are pertinent to the Contract, including records pertaining to Overhead and indirect costs, for the purpose of making audit, examination, excerpts and transcripts. If for any reason, any part of the Work or this Contract shall be subject to litigation, Contractor shall retain all such records until all litigation is resolved and Contractor shall continue to provide Owner and/or its agents with full access to such records until such time as all litigation is complete and all periods for appeal have expired and full and final satisfaction of any judgment, order or decree is recorded and Owner receives a record copy of documentation from Contractor.

L.14 WAIVER

Failure of the Owner to enforce any provision of this Contract shall not constitute a waiver or relinquishment by the Owner of the right to such performance in the future nor of the right to enforce any other provision of this Contract.

L. 15 NO ATTORNEY FEES.

In the event any arbitration, action or proceeding, including any bankruptcy proceeding, is instituted to enforce any term of this Contract, each party shall be responsible for its own attorneys' fees and expenses.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

PERFORMANCE BOND

Bond No.: 107912763
Solicitation: #2023-61
Project Name: CUP Expansion Equipment Installation Project

Travelers Casualty and Surety Company of America (Surety #1)	Bond Amount No. 1:	$1,194,000.00
_____ (Surety #2)*	Bond Amount No. 2:*	$_____
* *If using multiple sureties*	Total Penal Sum of Bond:	$1,194,000.00

We, Hydro-Temp Mechanical, Inc. as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto Clackamas County, the sum of (Total Penal Sum of Bond) One Million One Hundred Ninety-Four Thousand & 00/100ths Dollars (Provided, that we the Sureties bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety); and

WHEREAS, the Principal has entered into a contract with Clackamas County, along with the plans, specifications, terms and conditions of which are contained in the above-referenced Solicitation; and

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Performance Bond by reference, whether or not attached to the contract (all hereafter called "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal herein shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things undertaken by Contractor to be performed under the Contract, upon the terms set forth therein, and within the time prescribed therein, or as extended as provided in the Contract, with or without notice to the Sureties, and shall defend, indemnify, and save harmless Clackamas County and its elected officials, officers, employees and agents, against any direct or indirect damages or claim of every kind and description that shall be suffered or claimed to be suffered in connection with or

arising out of the performance of the Contract by the Principal or its subcontractors, and shall in all respects perform said contract according to law, then this obligation is to be void; otherwise, it shall remain in full force and effect for so long as any term of the Contract remains in effect.

Nonpayment of the bond premium will not invalidate this bond nor shall Clackamas County, be obligated for the payment of any premiums.

This bond is given and received under authority of Oregon Revised Statutes Chapter 279C and the Clackamas County Local Contractor Review Board Rules, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES.

Dated this 7th day of SEPTEMBER, 2023.

PRINCIPAL: Hydro-Temp Mechanical, Inc.

By: _____
Signature

VICE PRESIDENT
Official Capacity

Attest: _____
Corporation Secretary

SURETY: Travelers Casualty and Surety Company of America

[Add signatures for each if using multiple bonds]

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany each bond]

Chloe Lyons
Name

_____
Signature

Anchor Insurance & Surety, Inc.
One Centerpointe Drive, Suite 190
Address

Lake Oswego, OR 97035
City State Zip

(503) 224-2500 (503) 224-9830
Phone Fax

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Chloe Lyons** of **PORTLAND**, **Oregon**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this 7th day of SEPTEMBER, 2023

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

PAYMENT BOND

Bond No.: 107912763
Solicitation: #2023-61
Project Name: CUP Expansion Equipment Installation Project

Travelers Casualty and Surety Company of America (Surety #1)	Bond Amount No. 1:	$1,194,000.00
_____ (Surety #2)*	Bond Amount No. 2:*	$ _____
* *If using multiple sureties*	Total Penal Sum of Bond:	$1,194,000.00

We, Hydro-Temp Mechanical, Inc., as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto Clackamas County, the sum of (Total Penal Sum of Bond) One Million One Hundred Ninety-Four Thousand & 00/100ths Dollars (Provided, that we the Sureties bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety); and

WHEREAS, the Principal has entered into a contract with Clackamas County, along with the plans, specifications, terms and conditions of which are contained in above-referenced Solicitation; and

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Payment Bond by reference, whether or not attached to the contract (all hereafter called "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and schedule of contract prices which are set forth in the Contract and any attachments, and all authorized modifications of the Contract which increase the amount of the work, or the cost of the Contract, or constitute authorized extensions of time for performance of the Contract, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things by it undertaken to be performed under said Contract and any duly authorized modifications that are made, upon the terms set forth therein, and within the time prescribed therein, or as extended therein as provided in the Contract, with or without notice to the Sureties, and shall defend, indemnify, and save harmless Clackamas County and its elected officials, officers, employees and agents, against any claim for direct or indirect damages of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Contractor or its subcontractors, and shall promptly pay all persons supplying labor, materials or both to the Principal or its subcontractors for prosecution of the work provided in the Contract; and shall promptly pay all contributions due the State Industrial Accident Fund and the State Unemployment Compensation Fund from the Principal or its subcontractors in connection with the performance of the Contract; and shall pay over to the Oregon Department of Revenue all sums required to be deducted and retained from the wages of employees of the Principal and its subcontractors pursuant to ORS 316.167, and

shall permit no lien nor claim to be filed or prosecuted against Clackamas County on account of any labor or materials furnished; and shall do all things required of the Principal by the laws of this State, then this obligation shall be void; otherwise, it shall remain in full force and effect for so long as any term of the Contract remains in effect.

Nonpayment of the bond premium will not invalidate this bond nor shall Clackamas County be obligated for the payment of any premiums.

This bond is given and received under authority of Oregon Revised Statutes Chapter 279C and the Clackamas County Local Contractor Review Board Rules, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES:

Dated this 7th day of SEPTEMBER, 2023.

PRINCIPAL: Hydro-Temp Mechanical, Inc.

By: _____
Signature

VICE PRESIDENT
Official Capacity

Attest: _____
Corporation Secretary

Travelers Casualty and
SURETY: Surety Company of America
[Add signatures for each if using multiple bonds]

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany each bond]

Chloe Lyons
Name

_____
Signature

Anchor Insurance & Surety, Inc.
One Centerpointe Drive, Suite 190
Address

Lake Oswego, OR 97035
City State Zip

(503) 224-2500 (503) 224-9830
Phone Fax

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Chloe Lyons** of **PORTLAND**, **Oregon**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this 7th day of SEPTEMBER, 2023

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT
PROJECT INFORMATION, PLANS, SPECIFICATIONS AND DRAWINGS

PROJECT: #2023-61 CUP Expansion Equipment Installation Project

Background

When the Central Utility Plant ("CUP") was built, in conjunction with the Development Services Building ("DSB"), it was engineered and prepared for the addition of more equipment so as to attain a full build-out in support of new buildings on the Red Soils Campus. As such, it stands ready for the addition of a chiller, a number of boilers, and another cooling tower. Currently with the County building the new Courthouse, they are ready for this equipment to be installed.

Current Equipment

The current equipment in the CUP is as follows:
1ea - York TK Series Chiller – 1000 ton – Model #:YKHFJBJ2-CYFS
1ea – Evapco Cooling Tower – 340 ton – Model #:AT39942
2ea – Aerco Benchmark Boiler – 2mil/btu-hr – Model#:BMK2000
This equipment is supported and made operational by the pumps and VFD's that are part of the system. These are all controlled by and integrated into the county's Johnson Controls Building Automation System. (BAS)

New Equipment

The new equipment needed to build out the CUP for support of the New Courthouse has been specified as follows:
1ea – York Magnetic Bearing Chiller – 960 ton – Model#:YMC2
1ea – Evapco Cooling Tower – 340 ton – Model#:AT39-942
2ea – Aerco Benchmark Boiler – 2mil/btu-hr – Model#:BMK2000
2ea – Riello Dual Fuel Boiler – 3mil/btu-hr – Model RTC-80 3000

In support of this new equipment will be the appropriate pumps and Variable Frequency Drives ("VFD"). Also there will be new controls being procured to allow this new equipment to be operated and controlled by our current BAS system. The equipment has been specified as it matches the CUP's current equipment and will allow for continuity in controls, operation and maintenance.

Project Scope:

Clackamas County Facilities Management is soliciting a bid from qualified subcontractors to install the new equipment purchased by the County for the expansion of the CUP facility in order to support the new Courthouse building currently being built.

The contractor shall supply all materials and labor to complete their portion of the project in compliance with all local codes and regulations according to specifications and detailed requirements specified in the contracting documents.

The contractor is to install into the Central Utility Plant (CUP) the equipment purchased by the County for the expansion of the CUP. Utilizing all associated components, supplies and materials needed to complete this project.

The contractor is responsible for installing the new equipment in accordance with the attached project specifications and drawings.

The contractor is responsible supplying any components, (piping, valves, fuel storage, etc.) that are necessary for the successful completion of the installation.
The contractor is responsible for hauling away and removing all construction debris from working areas, including leaving a clean work site.

Key Dates:
All Basic Bid Work may begin as soon as the Notice to Proceed ("NTP") is issued
Substantial Completion: March 31, 2024
Final Completion: June 30, 2024

The Scope further includes the following Plans, Specifications and Drawings:

- Section 23 00 00- Heating, Ventilating and Air Conditioning (HVAC) Basic Requirements (15 pages)
- Section 23 05 19- Meters and Gauges for HVAC Piping (8 Pages)
- Section 23 05 23- General Duty Valves for HVAC Piping (9 Pages)
- Section 23 05 29- Hangers and Supports for HVAC piping, ductwork and equipment (16 pages)
- Section 23 05 33- Heat Tracing for HVAC Piping (3 pages)
- Section 23 05 48- Vibration and Seismic Controls for HVAC Equipment (15 pages)
- Section 23 05 53- Identification for HVAC Piping, Ductwork and Equipment (6 pages)
- Section 23 05 93- Testing, Adjusting and Balancing for HVAC (20 pages)
- Section 23 07 00- HVAC Insulation (8 pages)
- Section 23 11 13- Facility Fuel-Oil Piping and System (13 pages)
- Section 23 11 23- Facility Fuel- Natural Gas Piping and System (7 pages)
- Section 23 21 13- HVAC Piping (8 pages)
- Section 23 21 16- Hydronic Piping Specialty Ties (6 pages)
- Section 23 21 23- Hydronic Pumps (3 pages)
- Section 23 25 00- HVAC Water Treatment (11 pages)
- Section 23 52 00- Heating Boilers (2 pages)
- Section 23 64 00- Packaged Water Chillers (3 pages)
- Section 23 65 00- Cooling Towers (2 pages)
- Mechanical Symbol List (7 pages)

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DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

SECTION 23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.

2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

A. Contents of Section applies to Division 23, HVAC Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:

a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b. Drawings

c. Addenda

d. Owner/Architect Agreement

e. Owner/Contractor Agreement

f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Oregon:

a. OAR - Oregon Administrative Rules

b. 2021 OESC - Oregon Electrical Specialty Code

c. 2022 OFC - Oregon Fire Code

d. 2022 OMSC - Oregon Mechanical Specialty Code

e. 2021 OPSC - Oregon Plumbing Specialty Code

f. 2022 OSSC - Oregon Structural Specialty Code

g. 2021 OEESC - Oregon Energy Efficiency Specialty Code

h. 2011 Oregon Elevator Specialty Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act

2. ABMA - American Bearing Manufacturers Association

3. ADA - Americans with Disabilities Act

4. AHRI - Air-Conditioning Heating & Refrigeration Institute

5. AMCA - Air Movement and Control Association

6. ANSI - American National Standards Institute

7. ASCE - American Society of Civil Engineers

8. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers

9. ASHRAE Guideline 0, The Commissioning Process

10. ASME - American Society of Mechanical Engineers

11. ASPE - American Society of Plumbing Engineers

12. ASSE - American Society of Sanitary Engineering
13. ASTM - ASTM International
14. AWWA - American Water Works Association
15. CFR - Code of Federal Regulations
16. CGA - Compressed Gas Association
17. CISPI - Cast Iron Soil Pipe Institute
18. EPA - Environmental Protection Agency
19. ETL - Electrical Testing Laboratories
20. FM - FM Global
21. GAMA - Gas Appliance Manufacturers Association
22. HI - Hydraulic Institute Standards
23. IAPMO - International Association of Plumbing & Mechanical Officials
24. IFGC - International Fuel Gas Code
25. ISO - International Organization for Standardization
26. MSS - Manufacturers Standardization Society
27. NEC - National Electric Code
28. NEMA - National Electrical Manufactures Association
29. NFPA - National Fire Protection Association
30. NFGC - National Fuel Gas Code
31. NRCA - National Roofing Contractors Association
32. NSF - National Sanitation Foundation
33. OSHA - Occupational Safety and Health Administration
34. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
35. TEMA - Tubular Exchanger Manufactures Association
36. TIMA - Thermal Insulation Manufactures Association
37. UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

1.04 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor’s option, four separate submittals may be provided, consisting of long lead items, underground/site work, building work, and building automation system. Deviations will be returned without review.

3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.

4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

    a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.

    c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

d. For vibration isolation of equipment, list make and model selected with operating load and deflection.

e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Part 3 of this Section.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:

    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties proposing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to bid.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements

for shop drawings outside of these requirements.

a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:

    a. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

        1) Resubmit for review until review indicates no exception taken or make "corrections as noted".

        2) When submitting drawings for Engineer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owner's Instructions:

    a. Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.

        3) Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.

        4) Include product certificates of warranties and guarantees.

        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.

        6) Include copy of startup and test reports specific to each piece of equipment.

7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.

8) Include commissioning reports.

9) Include copy of valve charts/schedules.

10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.

d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturers' written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.06 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, equipment, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materals.

2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect/Engineer of any discrepancy.

H. Provide miscellaneous supports/metals required for installation of equipment, piping, and ductwork.

3.02 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Section 23 0548, Vibration and Seismic Controls for HVAC Equipment, and individual Division 23 HVAC Sections.

B. Equipment Importance Factor: 1.0.

C. Piping and Ductwork:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.03 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground system installation prior to backfilling.

2. Prior to covering walls.

3. Prior to ceiling cover/installation.

4. After major equipment is installed.

5. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.

2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.05 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.06 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust

as a result of improper storage to be replaced before installation.

2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect bright finished shafts, bearing housings and similar items until in service.

3.07 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.08 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.09 START UP

A. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.

3.10 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. See individual equipment Specifications for other painting.

4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.11 DEMOLITION

A. Confirm requirements in individual Division 23, HVAC Sections and the following:

1. Scope:

   a. It is the intent of these documents to provide necessary information and adjustments to the HVAC system required to meet code, and accommodate installation of new work.

   b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.

   c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.

2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.

3. Unless specifically indicated on Drawings, remove exposed, unused ductwork and piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap and patch surfaces to match surrounding finish.

4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

3.12 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Testing and Balancing Reports

b. Cleaning

c. Operation and Maintenance Manuals

d. Training of Operating Personnel

e. Record Drawings

f. Warranty and Guaranty Certificates

g. Start-up/Test Document

h. Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.

2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION

SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Pressure Gauges
2. Thermometers
3. Dial Thermometers
4. Separable Sockets
5. Thermometer Wells
6. Duct Thermometer Support Flanges
7. Differential and Filter Pressure Gauges
8. Pressure-Gauge Fittings
9. Test Plugs

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Maintenance Materials:

a. Extra gauge Oil for Inclined Manometers: One bottle.

b. Extra Pressure Gauges: One.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:

1. Trerice Model 600CB.
2. Dwyer Instruments, Inc.
3. Moeller Instrument Co., Inc.
4. Omega Engineering, Inc.

B. ASME B40.100, phosphor-bronze bourdon type, dry type.

1. Case: Cast aluminum, stem-mounted, flangeless.
2. Size: 4-1/2 inch diameter.
3. Window: Clear glass.
4. Connector: Brass.
5. Scale: White aluminum with black graduation and markings.
6. Pointer: Black, adjustable.
7. Mid-Scale Accuracy: One percent.
8. Scale: psi.

2.02 THERMOMETERS

A. Manufacturers:

1. Trerice Model BX9.
2. Ashcroft
3. Weiss
4. Marshaltown
5. Weksler

B. Adjustable Angle: Red-or blue-appearing organic liquid in glass: ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9-inch scale.

2. Window: Acrylic.
3. Scale: Aluminum, white background, black graduations and markings.
4. Stem: 3/4-inch NPT brass (aluminum for installation in air ducts).
5. Accuracy: 2 percent, per ASTM E 77.
6. Calibration: 0-160 with 2 degrees F graduations.

2.03 DIAL THERMOMETERS

A. Manufacturers:

1. Trerice Model 80742.
2. Ashcroft
3. Weiss
4. Marshaltown
5. Weksler

B. ASTM E 1, cast aluminum case, vapor or liquid actuated with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens, adjustable 360 degrees in horizontal plane. 180 degrees in vertical plane.

1. Size: 4-1/2-inch diameter dial.
2. Lens: Clear glass.
3. Length of Capillary: Minimum 6-feet (for remote reading if required).
4. Accuracy: 2 percent.
5. Calibration: 2 degrees F graduations.

2.04 SEPARABLE SOCKETS

A. Manufacturers:

1. Kimray
2. Weiss
3. Trerice

B. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

1. Material: Brass, for use in copper piping.
2. Material: Stainless steel, for use in steel piping.

3. Extension-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.

4. Insertion Length: To extend to center of pipe.

5. Cap: Threaded, with chain permanently fastened to socket.

6. Heat Transfer Fluid: Oil or graphite.

2.05 THERMOMETER WELLS

A. Manufacturers:

1. Ashcroft

2. Omega

3. Weiss

B. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

1. Material: Brass for use in copper piping.

2. Material: Stainless steel, for use in steel piping.

3. Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.

4. Insertion Length: To extend to center of pipe.

5. Cap: Threaded, with chain permanently fastened to socket.

6. Heat Transfer Fluid: Oil or graphite.

2.06 DUCT THERMOMETER SUPPORT FLANGES

A. Manufacturers:

1. Trerice

2. Ashcroft

3. Weiss

4. Marshaltown

5. Weksler

B. Description: Flanged fitting bracket for mounting in hole of duct, with threaded end for attaching thermometer.

1. Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of exterior insulation.

2. Insertion-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation lining.

2.07 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Manufacturers:

1. Orange Gauges
2. Midwest
3. Or approved equivalent.

B. Service: Air and non-combustible, compatible gases (Natural Gas option available.)

C. Wetted Materials: Consult factory.

D. Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.

E. Accuracy: Plus or minus 2 percent of full scale throughout range at 70 degrees F.

F. Pressure Limits: Minus 20 Hg to 15 PSIG.

G. Overpressure: Relief plug opens at approximately 25 PSIG standard gauges only.

H. Temperature Limits: 20 to 140 degrees F.

I. Size: 4-inch diameter dial face.

J. Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientation.

K. Process Connections: 1/8-inch female NPT duplicate high and low pressure taps, one pair side and one pair back.

L. Standard Accessories: Two 1/8-inch NPT plugs for duplicate pressure taps, two 1/8-inch pipe thread to rubber tubing adapter and three flush mounting adapters with screws.

2.08 PRESSURE-GAUGE FITTINGS

A. Manufacturers:

1. Omega
2. Weiss
3. Trerice

B. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

C. Syphons: NPS 1/4 (DN8) coil of brass turbine with threaded ends.

D. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.09 TEST PLUGS

A. Manufacturers:

1. Petes Plug

2. Or approved equivalent.

B. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

C. Body: Length as required to extend beyond insulation.

D. Pressure Rating: 500 PSIG (3450 kPa) minimum.

E. Core Inserts: One or two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gauge.

F. Core Material for Air, Water, Oil and Gas: 20 to 200 degrees F (minus 7 to plus 93 degrees Celsius), chlorosulfonated polyethylene synthetic rubber.

G. Test Plug Cap: Gasketed and threaded cap, with retention chain or strap.

H. Test Kit: Pressure gauge and adapter with probe, two bimetal dial thermometers, and carrying case.

1. Pressure Gauge and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Provide instruments with scale ranges selected according to service with largest appropriate scale.

3.02 PRESSURE GAUGES

A. Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

B. Locations: Install in the following locations as a minimum, and elsewhere as indicated.

1. At each pump inlet and outlet.

2. At inlet and discharge of each pressure reducing valve.

3. At makeup water service outlets.

4. At inlet and discharge of each chiller and boiler.

C. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust to final angle, clean windows and lenses, and calibrate to zero.

E. Pressure Gauge Range/Graduations:

System	Pressure (PSI)	Graduations (PSI)
Chilled Water	0-100	1
Heating Water	0-100	1
Condenser Water	0-100	1
Compressed Air	0-160	1
Steam	0-30	0.2

3.03 THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

B. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

C. Adjust to final angle, clean windows and lenses, and calibrate to zero.

D. Thermometer Range/Graduations:

System	Temperature (degree F)	Graduations (degrees F)
Chilled Water	25-125	1
Condenser Water	25-125	1
Heating Water	30-240	2
Steam and Condensate	50-400	5

3.04 DIAL THERMOMETERS

A. Install in vertical upright position, tilted so as to be easily read at floor.

3.05 SEPARABLE SOCKETS

A. Inspect the openings in the vessel for foreign material and clean the connection ports to remove scale, chips and debris.

B. Install thermostats with separable sockets. Install the separable socket using good piping practice. Be sure to use TFE tape or pipe thread sealant on external pipe threads.

C. Never stand directly over or in front of a valve or controller when the system is pressurized.

D. Assure the separable socket is completely submerged in liquid or flow stream. Partial submersion will give erratic temperature transfer to thermostat.

E. Pack separable socket full with high temp bearing grease. This helps in heat transfer and prevents air space.

3.06 THERMOMETER WELLS

A. Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.

3.07 DUCT THERMOMETER SUPPORT FLANGES

A. Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

3.08 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial cc an be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.

B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.

C. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

D. Locations: Install in the following locations, and elsewhere as indicated.

1. At each pump inlet and outlet.

2. At inlet and discharge of each pressure reducing valve.

3. At make-up water service outlets.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

3.09 PRESSURE-GAUGE FITTINGS

A. Install per manufacturer's instructions and recommendations.

B. Reference "Pressure Gauges" Article above.

3.10 TEST PLUGS

A. Locate test plugs adjacent to thermometers and thermometer sockets, adjacent to pressure gauges and pressure gauge taps, adjacent to control device sockets, or where indicated.

END OF SECTION

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Gate Valves
2. Balancing Valves
3. Ball Valves
4. Butterfly Valves
5. Swing Check Valves
6. Wafer Check Valves

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:

1. Apollo

2. Armstrong
3. ASCO
4. Cla-Val
5. Conbraco
6. Crane
7. Clow
8. Griswold
9. Hammond
10. Hays
11. Jenkins
12. Josam
13. Kennedy
14. Milwaukee
15. Mueller
16. Nibco
17. Red-White Valve
18. Smith
19. Stockham
20. Tour & Andersson
21. Wade
22. Watts
23. Wilkins
24. Zurn

C. Gate Valves:

1. See Valves General above.

D. Balancing Valves:

1. Griswold
2. Hays

3. Armstrong CBV
4. Tour & Andersson
5. Victaulic (T&A Valves only)

E. Ball Valves:

1. See Valves General above.
2. NSF Valves:
   a. Clow
   b. Kennedy
   c. Nibco

F. Butterfly Valves:

1. See Valves General above.

G. Swing Check Valves:

1. See Valves General above.

H. Wafer Check Valves:

1. See Valves General above.

2.02 VALVES - GENERAL

A. General:

1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6 inches and smaller. Provide gear operators for quarter-turn valves 8 inches and larger and plug valves 5 inches and larger. Provide chain-operated sheaves and chains for overhead valves installed over 5 feet above finished floor.
3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
   a. Basis of Design Product: Subject to compliance with requirements. Provide NIBCO NIB-SEAL handle extension or comparable product by one of the following.

1) Conbraco Industries, Inc.: Apollo Div.

3. Butterfly Valves: With extended neck.

C. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.

2. Grooved: With grooves according to AWWA C606.

3. Solder Joint: With sockets according to ASME B16.18.

4. Threaded: With thread according to ASME B1.20.1.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:

1. Shutoff and Isolation Valves:

a. Pipe Sizes 3 Inches and Smaller: Ball valve.

b. Pipe Sizes 4 Inches and Larger: Butterfly valve. Gate valve acceptable if allowed by Owner.

2. Drain Service: Ball valves.

3. Strainer Blow-Off: Ball valve.

4. Check Valves: Swing or Wafer.

2.03 GATE VALVES

A. Gate Valves - Class 125:

1. 2 Inches and Smaller: MSS SP-80, Class 125, ASTM B62 cast bronze composition body, bonnet and solid disc, copper-silicon non-rising stem, brass packing gland, Teflon impregnated packing and malleable iron hand-wheel.

2. 2-1/2 Inches and Larger: MSS SP-70, Class 125, ASTM A126 Grade B Ductile iron body, bolted bonnet an disc, bronze trim, copper silicon non-rising stem, bronze packing gland, Teflon impregnated packing and malleable iron hand-wheel.

B. Gate Valves - Class 150:

1. 2 Inches and Smaller: Class 150, MSS SP-80, ASTM B62 cast bronze body, bronze bonnet, bronze wedge, non-rising stem, brass packing gland, non-asbestos packing and aluminum or malleable iron hand-wheel.

2. 2 1/2 Inches and Larger: Class 150, MSS SP-70, ASTM A126 Grade B, IBBM, ductile iron body, bonnet and wedge, bronze trim, non-rising stem, brass packing gland, non-asbestos packing and cast iron hand-wheel.

C. Gate Valves - Class 250:

1. 2 Inches and Smaller: Class 250, SWP, MSS SP-80, ASTM B61, cast bronzed body, bronze bonnet, bronze wedge, non-rising stem, bronze packing gland, non-asbestos packing and aluminum or malleable iron hand-wheel.

2. 2 1/2 Inches and Larger: Class 250, SWP, MSS, SP-70, ASTM A126, Grade B cast iron body, cast iron bonnet, cast iron wedge, bronze trim, non-rising stem, brass packing gland, non-asbestos packing and cast iron hand-wheel.

2.04 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:

1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:

a. Precise flow measurement.

b. Precision flow balancing.

c. Positive drip-tight shutoff.

2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of four full 360 degree handwheel turns. 90 degree style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.

3. 2-1/2 Inches and Larger: Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch: five turns; sizes 4-inch to 6-inch: 6 turns; sizes 8-inch to 10-inch: 12 turns; and size 12-inch: 14 turns. Provide flange adapters to prevent rotation.

C. Automatic Balance Valve:

1. 1/2 Inch and Larger: Construction and attachment style as required by piping system. Internal working parts and removable flow cartridge to be stainless steel. Valves be factory set and automatically limit flow to specified capacities with 5 percent plus or minus accuracy over entire operating pressure differential.

2.05 BALL VALVES

A. Ball valves on brazed piping are to be three-piece.

B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free

brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.

C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.

D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.06 BUTTERFLY VALVES

A. Select lug type valves.

B. 6 Inches and Smaller: 200 PSI, ductile iron body, extended neck, stainless steel stem with stainless steel disc, reinforced resilient EPDM seat, memory stop control, lever handle through 5 inches, size and worm gear operator for 6 inches and larger. Mount stem in horizontal position. Manual lever and lock Nibco LD2000, Gruvlok 7700 for mechanical coupling fittings. MSS SP-67, Type 1.

C. 8 Inches and Larger: 200 PSI, ductile iron body, extended neck, stainless steel disc and stem reinforced resilient EPDM seat, memory stop control, lever handle through 5 inches, size and worm gear operator for 6 inches and larger. Mount stem in horizontal position. Manual lever and Gruvlok Series 7700 for mechanical coupling fittings. MSS SP-67, Type 1.

2.07 SWING CHECK VALVES

A. 2 Inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80, Type 4.

B. 2-1/2 Inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MSS SP-71, Type 1.

C. Gruvlok Check Valve: Horizontal installation. Working pressure to 300 PSI. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.08 WAFER CHECK VALVES

A. Twin disc, Class 125 spring actuated designed to be installed with gaskets between two standard Class 125 flanges. 200 PSI, cast iron body, aluminum bronze disc. Nibco W-920-W.

B. Check Valve: PPS coated ductile iron body, ASTM A536, aluminum bronze nonslamming disc, stainless steel spring and shaft. Rubber seat for intended service.

PART 3 - EXECUTION

3.01 GENERAL VALVE INSTALLATION REQUIREMENTS

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set gate valves closed to prevent rattling.

4. Set ball open to minimize exposure of functional surfaces.

5. Set butterfly valves closed or slightly open.

6. Block check valves in either closed or open position.

B. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

C. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

D. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

E. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

F. Do not attempt to repair defective valves; replace with new valves.

G. Install valves per manufacturer's recommendations.

H. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

I. Purge and clean piping to be connected to valve.

J. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.

K. Determine that the valve and its piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that mating flanges are in line and parallel to minimize straining on joints and valve body.

L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.

N. Stem Selection: Outside screw and yoke stems, except provide inside screw, nonrising stem where space prevents full opening of OS&Y valves.

O. Seats: Renewable seats, except where otherwise indicated.

P. When soldering, use paste flux that is approved by the manufacturer for use with lead-free alloys.

Q. Boiler isolation valves with adjustable packing gland per CSD-1 requirements.

R. Valve Adjusting and Cleaning:

1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.

2. Valve Identification: Tag valves per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

S. General Requirements for Valve Applications:

1. If valve applications are not indicated, use the following:

a. Shutoff Service: Ball, Butterfly, or Gate valves.

b. Butterfly Valve Dead-End Service: Single-flange (lug) type.

c. Throttling Service: Balancing valves.

d. Pump-Discharge Check Valves:

1) 2 Inches and Smaller: Swing or spring-loaded lift check valves with bronze disc.

2) 2-1/2 Inches and Larger: Swing check valves with lever and weight or with spring or wafer - seat check valves.

e. Provide isolation valve, check valve, automatic flow control valve and balancing valve on discharge side of pumps where indicated. Combination triple duty valves not allowed. Provide isolation valve and strainer on suction side of pump.

2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

3. Valves, except wafer types, with the following end connections.

a. For Copper Tubing 2 Inches and Smaller: Threaded ends.

b. For Copper Tubing 2-1/2 Inches to NPS 4 Inches: Flanged ends.

c. For Copper Tubing 5 Inches and Larger: Flanged ends.

d. For Steel Piping 2 Inches and Smaller: Threaded ends.

e. For Steel Piping 2-1/2 inches to NPS 4 Inches: Flanged ends.

f. For Steel Piping 5 Inches and Larger: Flanged ends.

g. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.02 GATE VALVE INSTALLATION

A. See General Installation Requirements above.

3.03 BALANCING VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install with flow in the direction of the arrow on the valve body and install at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Install devices in accordance with manufacturer's recommendations to automatically balance flow in piping loops as indicated.

C. For venturi valves less than 1-1/2-inch pipe size, provide valve sized for flow to coil. Provide transitions on both inlet and outlet of valve if valve is less than line size.

3.04 BALL VALVE INSTALLATION

A. See General Installation Requirements above.

3.05 BUTTERFLY VALVE INSTALLATION

A. See General Installation Requirements above.

3.06 SWING CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install in the horizontal or vertical position with upward flow. Install for proper direction of flow. Install with minimum three pipe diameters of straight pipe upstream of valve.

3.07 WAFER CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install between two flanges in horizontal or vertical position, position for proper direction of flow.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
3. Install ductwork and piping per SMACNA's requirements.
4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Welding:

a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".

2. Welding for Hangers:

a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.

3. Engineering Responsibility:

a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified Structural Professional Engineer.

1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.

5. Support systems to be supplied by a single manufacturer.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:

1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.

2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:

1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.

2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

E. Provide seismic restraint hangers and supports for piping, ductwork and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:

1. Anvil International
2. B-Line Systems, Incorporated
3. Erico Company, Incorporated
4. Nelson-Olsen Incorporated
5. Rilco Manufacturing Company, Incorporated
6. Snappitz Thermal Pipe Shield Manufacturing
7. Unistrut Corporation

B. Wall and Floor Sleeves:

1. Thunderline Corporation “Link Seal”.
2. Or approved equivalent.

C. Building Attachments:

1. Anchor-It
2. Gunnebo Fastening Corporation
3. Hilti Corporation
4. ITW Ramset/Red Head
5. Masterset Fastening Systems, Incorporated

2.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.

B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.

C. Channel Hanging System:

1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 Grade 33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.

2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.

E. Pipe Hangers:

1. Pipe Rings for Hanger Rods:

a. Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or approved equivalent.

b. Pipe Sizes 2-1/2-inches and Larger: Clevis type hangers with adjustable nuts on rod, UL listed. Anvil figure 260, Erico 400, or approved equivalent.

c. Pipe hangers to have same finish as hanger rods.

F. Pipe Saddles and Shields:

1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.

2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.

H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.

I. Pipe Guides:

1. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause

condensation on any surface.

2. Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.

J. Thermal Hanger Shield Inserts:

1. 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.

2. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.

3. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.

4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

6. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.

7. Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.

K. Freestanding Roof Supports: Polyethylene high-density UV resistant quick "pipe" block with foam pad.

2.03 WALL AND FLOOR SLEEVES

A. Below Grade or High Water Table Areas:

1. "Link-Seal" Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal.

2. Provide Type S unless otherwise noted.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Fabricated Accessories:

1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.

2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:

a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.

b. Sleeve Sizes 5-6-inches: 16 gauge.

c. Sleeve Sizes 7-inches and Larger: 14 gauge.

d. Fire-Rated Safing Material.

1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 pounds per cubic foot density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.

2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.04 BUILDING ATTACHMENTS

A. Beam Clamps:

1. MSS Type 19 and 23, wide throat, with retaining clip.

2. Universal Side Beam Clamp: MSS Type 20.

B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Anchor Bolts:

1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.

3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.

4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.05 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.06 MISCELLANEOUS METAL AND MATERIALS

A. General:

1. Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.

2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).

H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.

I. Grout:

1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.

3. Properties: Nonstaining, noncorrosive, and non gaseous.

4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.

B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.

C. Design hangers and supports to allow for expansion and contraction.

D. Provide aluminum supports for aluminum ductwork.

E. Provide stainless steel supports for stainless steel ductwork.

F. Support vertical ducts at maximum intervals of 16-feet and at each floor.

G. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

H. Install flexible ductwork per the more stringent of SMACNA HVAC Duct Construction Standards or the following:

1. Support horizontal duct runs at not more than 4 feet intervals.

2. Support vertical risers at not more than 6 feet intervals.

3. Limit sag between support hangers to 1/2-inch per foot of spacing support.

4. Supports shall be rigid and shall be not less than 1.5-inches wide at point of contact with the duct surface.

5. Duct bends shall be not less than 1.5 duct diameter bend radius.

I. Use double nuts and lock washers on threaded rod supports.

J. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.

K. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.

L. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.

M. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.

N. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.

O. Channel Support System Installation:

1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

2. Field assemble and install according to manufacturer's written instructions.

P. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Q. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

R. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

S. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.

T. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

U. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:

1. Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.

2. Use only one type by one manufacturer for each piping service.

3. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.

4. Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.

5. Provide copper-plated hangers and supports for uninsulated copper piping systems.

V. Plumber's Tape not permitted as pipe hangers or pipe straps.

W. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.

X. Pipe Ring Diameters:

1. Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.

2. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.

Y. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.

Z. Pipe Support Brackets: Support pipe with pipe slides.

AA. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.

BB. Pipe Guides:

1. Install on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Contact with chilled water pipe does not permit heat to be transferred in sufficient quantity to cause condensation on any surface.

2. Install approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.

CC. Heavy-Duty Steel Trapeze Installation:

1. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.

2. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

3. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

DD. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.

EE. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.

FF. Do not support piping from other piping.

GG. Fire protection piping will be supported independently of other piping.

HH. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

II. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.

JJ. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Do not exceed pipe stress limits according to ASME B31.9.
3. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
4. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.
5. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
6. Shield Dimensions for Pipe, not less than the following:
    a. NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
    b. NPS 4 (DN100): 12-inches long and 0.06-inch thick.
    c. NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
    d. NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
    e. NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
7. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
    a. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

KK. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

LL. Pipe Curb Assemblies:

1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.

2. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

MM. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

NN. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.

2. Riser clamps to be directly under fitting or welded to pipe.

a. Riser to be supported at each floor of penetration.

b. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

3.03 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

B. Fabricated Pipe Sleeves:

1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirements, and by waterproofing requirements.

2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.

3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.

4. Seal each end airtight with a resilient nonhardening sealer, UL listed, fire rated ASTM 814.

C. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:

1. Install fabricated pipe sleeve.

2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.

3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814.

D. Piping Penetrations Through Fire-Rated (One to Three Hour) Assemblies:

1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.

2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

3.04 BUILDING ATTACHMENTS

A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.

B. Select size of building attachments to suit hanger rods.

C. Space attachments within maximum piping span length indicated in MSS SP-58.

D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

H. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.

I. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.

J. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

K. Anchor Bolts:

1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.

2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.05 FLASHING

A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.

B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.06 MISCELLANEOUS METAL AND MATERIALS

A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

B. Finishes:

1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.

2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.

3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.

I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

M. Provide galvanized components for items exposed to weather.

3.07 FIRE RATED SUPPORTS

A. Provide fire rated support as required by Codes.

END OF SECTION

SECTION 23 05 33 - HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Heat Trace Cable (Freeze Protection).

B. Provide for the following systems. See drawings for specific quantities and locations, including but not limited to:

1. Cooling Tower Makeup Water

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 07 00, HVAC Insulation

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 718K, Pipe Heating Cable.

2. CSA 3A, 3B, and 3C.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Project Record Documents: Record physical locations of thermostats.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Heat Trace Cable (Freeze Protection):

1. Thermon/FLX
2. Chromalox/SRF
3. Raychem/XL-Trace
4. Nelson/CLT

2.02 HEAT TRACE CABLE (FREEZE PROTECTION)

A. General: Provide complete UL listed system of heating cables and components listed specifically for maintaining pipe temperature over entire piping system exposed to freezing temperatures.

B. Materials

1. Cable: Self-regulating flat, flexible, low-heat density, parallel electric heater strip consisting of two stranded circuit conductors enclosed in semi-conductive, polymer core insulated with plastic jacket protected with tinned-copper braid. Ability to overlapped without creating hot spots and suitable for application on plastic, copper or steel pipe.
2. Voltage: See Electrical Drawings. Provide power connections, end seals, splices tap-offs and tees for a complete system.
3. Controls: Thermostat with fixed setpoint of 40 degrees F, remote bulb and capillary sensor enclosed in a NEMA 4 enclosure.

C. Minimum Exposure Temperature: 150 degrees F continuous.

PART 3 - EXECUTION

3.01 HEAT TRACE CABLE INSTALLATION

A. Heat Trace (Freeze Protection):

1. Location: Provide heat trace on piping exposed to freezing conditions.
2. Install cable parallel to pipe or spiral wrap to achieve power density per linear foot of pipe to prevent freezing.
3. Attach heat trace cable to pipe with polyester tape; increments not exceeding 1-foot, 0-inches.
4. Install thermostat capillary and bulb to pipe with polyester tape assuring a firm bulb contact with pipe. Install bulb without contact to heat cable. Maximum 12-inch spacing between tape.

5. Install thermostat at accessible location adjacent to pipe with minimum of exposed capillary.

6. Labeling: Provide “Electric Traced” label to outside of the pipes thermal insulation on alternating sides. Locate labels at intervals of 5- to 15-feet over entire length of heat tracing.

7. Coordinate installation with work under Division 26, Electrical for electrical service to each thermostat.

8. Coordinate application of heat tape with pipe insulation and weather jacketing.

END OF SECTION

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Vibration Isolation
2. Seismic Restraint Devices
3. Factory Finishes
4. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork

B. General:

1. Vibration isolation for mechanical ductwork, piping and equipment.
2. Seismic restraint for mechanical ductwork, piping and equipment.
3. Seismic Certification for equipment, hangers and systems.
4. Special inspections for systems.

C. Scope of Work:

1. Vibration isolation and seismic restraint of new equipment and systems within project boundary defined in drawings.
2. Vibration isolation and seismic restraint of new equipment and systems in existing buildings to points of connection with existing systems.
3. Provide supplementary structural steel for seismic restraint systems. No hanging from roof deck is permitted on this project, unless specifically allowed by Structural Engineer of Record in writing prior to bid.

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Vibration Isolation:

a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.

b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:

1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.

2) Equipment mounting holes.

3) Dimensions.

4) Size and location of concrete and steel bases and curbs.

5) Isolation selected for each support point.

6) Details of mounting brackets for isolator.

7) Weight distribution for each isolator.

8) Details of seismic snubbers.

9) Code number assigned to each isolator.

c. Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.

2. Seismic Restraint:

a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by a professional Structural Engineer licensed in State of Oregon.

b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by professional Structural Engineer licensed in State of Oregon.

3. Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.

4. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.

5. Welding certificates.

6. Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Vibration Isolation:

a. Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.

b. Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.

c. Isolator Stability:

1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.

2) Springs have minimum additional travel to solid equal to 50 percent of rated defection.

3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.

d. Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.

2. Seismic Restraint:

a. Code and Standard Requirements:

1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of ASCE 7-16.

b. Equipment Importance Factor: 1.0.

c. Certification: See Seismic Design Table or schedules on Drawings for equipment, systems and seismic-restraint devices designated to have seismic certification/qualification. Horizontal and vertical load testing and analysis performed according to ASCE 7-16. Anchorage systems to bear anchorage preapproval number from an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing or calculations, if preapproved ratings are not available. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be sealed by qualified licensed professional engineer in State of Oregon. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to weakest mode.

d. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force

prescribed in local building code:

1) Floor- or roof-mounted equipment weighing 400 pounds or greater.

2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.

3) In-line duct devices connected to ductwork weighing 75 pounds or greater.

4) Housekeeping slabs: provide reinforcement and anchorage to building structure.

e. Where required, seismic sway bracing of suspended duct and piping meet following:

1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.

2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.

3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.

f. Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:

1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.

2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.

3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.

C. Seismic restraints, including anchors to building structure, be designed by registered professional Structural Engineer licensed in State of Oregon. Design includes:

1. Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.

2. Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.

3. Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.

4. Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered professional Structural Engineer who designed layout of

braces.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Vibration Isolation:

1. The VMC Group
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. M.W. Saussé - Vibrex
6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

B. Seismic Restraint Devices:

1. The VMC Group
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. M.W. Saussé - Vibrex
6. California Dynamics Corporation
7. Cooper B-Line Tolco
8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
9. Hilti, Inc.

C. Factory Finishes:

1. Kynar 500 Fluoropolymer Coating

2. Or approved equivalent.

D. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:

1. The VMC Group
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Hilti, Inc.
5. Cooper B-Line, Inc.
6. California Dynamics Corporation
7. Unistrut
8. ISAT, Inc.
9. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

2.02 VIBRATION ISOLATION

A. Type 1 - Neoprene Pad: Natural rubber waffle pads, arranged in single or multiple layers, 3/4-inch thick per layer with pattern repeating on 1/2-inch centers; 50 durometer hardness; maximum loading 60 PSI. Minimum 1/4-inch thick steel load distribution plate and 1/16-inch shim plates between layers, factory cut to sizes matching requirements of supported equipment. Molded bridge with neoprene anchor bolt bushing and flat washer face to prevent metal to metal contact. Number of layers required for equipment scheduled. Mason Type: Super WMH.

B. Type 2 - Neoprene Mount: Double-deflection type, with ductile-iron housing containing two separate and opposing, oil-resistant natural rubber or bridge bearing neoprene elements, factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Neoprene elements to prevent metal to metal contact during normal operation. Minimum static deflection of 0.30-inches. Mason Type: BR.

C. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
2. Minimum Additional Travel: 50 percent of required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside. Baseplates limit floor load to 100 PSIG (690 kPa).

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

7. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.

8. Mason Type: SLFH or SLF.

D. Type 4a - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops (out of contact during normal operation) to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Restraining bolts have large rubber grommets to provide cushioning in vertical and horizontal directions. A minimum clearance of 3/8-inch maintained around restraining bolts so as not to interfere with spring action.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.

7. Mason Type: SLR.

E. Type 4b - Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint with neoprene acoustical cup, spring inspection ports and rebound adjustment ports.

2. Base: Factory drilled for bolting to structure.

3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.

4. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.

5. Mason Type: SSLFH.

F. Type 5a - Restrained Elastomeric Hangers: Double-deflection type, with molded, oil-resistant natural rubber or bridge bearing neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range. Seismic rebound steel and bonded LDS rubber washer to limit upward seismic movement. Mason Type: RWHD.

G. Type 5b - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Mason Type: 30N.

H. Type 5c - Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Mason Type: RW30.

I. Type 6 - Horizontal Thrust Restraints: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

8. Mason Type: WBI or WBD.

J. Type 7 - Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on isolation material of 500 PSIG (3.45 MPa) and for equal resistance in all directions. Mason Type: ADA.

K. Type 8 - Resilient Pipe Vertical Sliding Guide: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin be removable and reinsertable to allow for selection of pipe movement. Guides be capable of motion to meet location requirements. Mason Type: VSG. Provide pipe expansion hangers to control load shifts as the riser expands or contracts, Mason HES.

L. Type FC-1, Flexible duct connectors. See Specification Section 23 33 00 Air Duct Accessories.

M. Type FC-2A, Flexible Pipe Connector, Steel:

1. 321 stainless steel, close pitch, annular corrugated hose.

2. Exterior Sleeve: 304 stainless steel, braided.

3. Pressure Rating: 125 PSI at 70 degrees F for 12-inch and smaller pipe.

4. Joint: ANSI Class 150 carbon steel flanges.

5. Size: Use pipe sized units.

6. Minimum Allowable Offset: 3/4-inch on each side of installed center line.

7. Basis of Design: Metraflex Model MLP.

N. Type FC-2B, Flexible Pipe Connector, Copper:

1. Inner Hose: Bronze, close pitch, annular corrugated hose.

2. Exterior Sleeve: Braided bronze (for piping over 2-inches, to be 3 pound braided stainless steel).

3. Minimum Allowable Pressure Rating: 125 PSI at 70 degrees F.
4. Joint: Sweat ends.
5. Size: Use pipe sized units.
6. Minimum Allowable Offset: 3/8-inch on each side of installed center line.
7. Basis of Design: Metraflex Model BBS.

O. Type FC-2C, Flexible Pipe Connector, Gas:

1. Inner Hose: 304 stainless steel.
2. Exterior Sleeve: Braided, 304 stainless steel.
3. Minimum Allowable Pressure Rating: 150 PSI at 70 degrees F up to 4-inch pipe.
4. Joint: Threaded carbon steel.
5. Minimum Allowable Offset: 3/4-inch on each side of installed center line.
6. Basis of Design: Metraflex GASCT.

P. Type FC-3, Flexible Compensator, Double Sphere:

1. Body: Molded twin spherical type. Neoprene with internal cord or wire.
2. Minimum Pressure Rating, Sizes 2-inch to 12-inch: 225 PSI at 170 degrees F.
3. Minimum Pressure Rating, Sizes 14-inch to 20-inch: 125 PSI at 170 degrees F.
4. Minimum Allowable Compression: 1-1/2 inches.
5. Minimum Allowable Elongation: 1-1/8 inches.
6. Minimum Allowable Offset: 1-1/8 inches.
7. Minimum Allowable Angular Movement: 20 degrees.
8. Joint: Steel flanges.
9. Accessories: Galvanized aircraft-type cable or control rods to prevent over extension.
10. Basis of Design: Metraflex Doublesphere.

2.03 SEISMIC RESTRAINT DEVICES

A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.

1. Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.

2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.

C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.

D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.04 FACTORY FINISHES

A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:

1. Conform to AAMA 605.2.

2. Apply coating following cleaning and pretreatment.

3. Cleaning: AA-C12C42R1X.

4. Dry system before final finish application.

5. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.

B. Finish:

1. Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.

2. Powder coating on springs and housings.

3. Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.

4. Baked enamel for metal components on isolators for interior use.

5. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

2.05 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to authorities having jurisdiction.

B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.

C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.

D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Set floor-mounted equipment with steel base rails on minimum 4-inch-high concrete housekeeping pads. Extend pad minimum 6-inches beyond footprint of equipment in each direction, but not less than twice the embedment depth of concrete anchors.

B. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.

C. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.

D. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances is isolation efficiency to be destroyed when bolting isolators to floor.

E. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.

F. Install Type 6 horizontal thrust restraints at centerline of thrust, symmetrical on either side of equipment.

G. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.

H. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

I. Examination:

1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.

2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

J. Testing: Perform following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.
3. Snubber minimum clearances.

K. Adjusting:

1. Adjust snubbers according to manufacturer's written recommendations.
2. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

L. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.

M. Demonstration: Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain air-mounting systems. Reference Division 01, General Requirements.

3.02 VIBRATION ISOLATION

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.

D. Install isolation as indicated on drawings by type and location and where indicated below.

E. Equipment Vibration Isolation Schedule:

Equipment	Size	Vibration Isolator Type	Minimum Deflection (in)
Chillers/Heat Pumps: Centrifugal, Screw or Scroll, Water or Air-Cooled	All	Type 4A or 4B, FC-3	1.5
Cooling Towers	All	B-1, Type 4A, FC-3	3.5
Boilers	All	Type 1 or 2, FC-2	0.3
Base-Mounted Pumps	0 to 5 HP	B-1, Type 1, FC-3	0.3
Base-Mounted Pumps	7.5+ HP	B-2, Type 1, FC-3	1.5

F. Isolation Mounts:

1. Install minimum of four seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts.
3. Provide flexible piping connection and flexible ductwork connection to equipment with isolation mounts or bases.

G. Isolating Hangers:

1. Support piping and ductwork connected to isolated equipment within equipment rooms on isolating hangers as scheduled on drawings. Unless otherwise noted, first three hangers from isolated equipment to have a minimum of 1/2 static deflection of equipment isolators. Other isolating hangers to have a minimum of 1/4 static deflection of equipment isolators.

2. Position isolating hanger elements as high as possible in hanger rod assembly, but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.

3. Unless otherwise noted, air supply units with internally isolated fans do not require isolating hangers for connecting pipes and ductwork.

4. Where parallel running pipes are hung together on an isolated trapeze, provide isolator deflections for largest determined by provisions for pipe isolation. Do not mix isolated and non-isolated pipes in same trapeze.

5. Install limit stops so they are out of contact during normal operation.

H. Adjusting:

1. Adjust isolators after piping systems have been filled and equipment is at operating weight.

2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

3.03 SEISMIC RESTRAINT DEVICES

A. Reference 3.01, General Installation Requirements.

B. Install in strict accordance with manufacturer's written instructions and certified submittal data.

C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.

D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install restraining cables no less than 45 Degrees from vertical. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

3.04 FACTORY FINISHES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Finishes to be factory-applied. No field patching or holidays allowed.

3.05 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Plastic Nameplates
2. Tags
3. Plastic Pipe Markers
4. Ceiling Tags

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Schedules:
    a. Submit valve schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.
2. Submit schedule of identification type, including material, for each class of tagged item.
3. Submit locations at which Valve Schedules will be installed.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.

2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 PLASTIC NAMEPLATES

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.

1. Letter Color: White.
2. Letter Height: 1/2-inch.
3. Background Color: Black.
4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

2.02 TAGS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 2-inch diameter.

C. Metal Tags: Polished Brass with stamped letters; tag size minimum 2-inch diameter with smooth edges.

D. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

E. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

F. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.

G. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7-inches.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

4. Color: Yellow background with black lettering.

2.03 PLASTIC PIPE MARKERS

A. Manufacturers:

1. Brady Corporation

2. Brimar

3. Champion America

4. Craftmark

5. Seton

B. Color: Conform to ASME A13.1 and ANSI Z535.1.

C. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

E. Lettering:

1. 3/4-inch to 1-1/4-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 1/2-inch high letters.
2. 1-1/2-inch to 2-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 3/4-inch high letters.
3. 2-1/2-inch to 6-inch Outside Diameter of Insulation or Pipe: 12-inch long color field, 1-1/4-inch high letters.
4. 8-inch to 10-inch Outside Diameter of Insulation or Pipe: 24-inch long color field, 2-1/2-inch high letters.
5. Over 10-inch Outside Diameter of Insulation or Pipe: 32-inch long color field, 3-1/2-inch high letters.

2.04 CEILING TAGS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Description: Steel with 3/4-inch diameter color coded head.

C. Color code as follows:

1. Yellow - HVAC equipment.
2. Red - Fire dampers/smoke dampers.
3. Blue - Heating/cooling valves.
4. Ceiling tile labels, machine generated, adhesive backed tape labels with black letters, clear tape.

PART 3 - EXECUTION

3.01 GENERAL - INSTALLATION

A. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.

B. Identify piping, concealed or exposed, with plastic pipe markers.

C. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and

equipment.

D. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

E. Degrease and clean surfaces to receive adhesive for identification materials.

F. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

G. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.

H. Install all products in accordance with manufacturer's instructions.

I. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

3.02 PLASTIC NAMEPLATES

A. Install plastic nameplates with corrosive-resistant mechanical fasteners.

B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.

C. Identify thermostats with nameplates.

3.03 TAGS

A. Use metal tags on piping 3/4-inch diameter and smaller.

B. Tag balancing valves and major dampers with balanced GPM or CFM indicated after balancing is completed and accepted.

C. Install tags with corrosion resistant chain.

D. Small devices, such as in-line pumps, may be identified with tags.

E. Identify valves with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.

F. Identify air terminal units and radiator valves with numbered plastic tags.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Install valve schedule at each mechanical room.

3.04 PLASTIC PIPE MARKERS

A. Install plastic pipe markers complete around pipe in accordance with manufacturer's instructions.

B. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

3.05 CEILING TAGS

A. Provide ceiling tags to locate valves, dampers, and equipment above accessible ceilings. Locate in corner of ceiling tee grid closest to equipment.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. General Requirements and Procedures
2. Pre-Construction Balance (Existing Systems)
3. Temperature Control Verification
4. Fundamental Procedures for Hydronic Systems
5. Pump Balancing Procedures
6. Variable Flow Hydronic Systems Additional Procedures
7. Primary-Secondary Flow Hydronic Systems Additional Procedures
8. Cooling Towers
9. Pre-Balance Reporting
10. Final Reports:
    a. Report Requirements
    b. General Report Data
    c. System Diagrams
    d. Chillers
    e. Cooling Towers
    f. Pumps
    g. Boilers
    h. Instrument Calibration
11. Additional Tests

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.

2. Pre-Construction Phase Report:

   a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:

      1) A complete set of report forms intended for use on the Project, with data filled in except for the field readings. Forms to be Project-specific.

      2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.

      3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications to be included.

      4) A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems to which they apply.

3. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.

4. Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 of this Section. Include a complete set of report forms intended for use on this Project.

5. Specify reports required because of editing procedures in Part 3 of this Section.

6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.

7. Sample Report Forms: Submit two sets of sample TAB report forms.

8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.

9. Final Report.

10. Provide additional submittals to commissioning authority as dictated in Commissioning Specifications.

1.05 QUALITY ASSURANCE

A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Acceptable TAB Agencies:

a. Oregon:

1) Air Introduction and Regulations Inc.

2) Accurate Air Balance, Inc.

3) Neudorfer Engineers

4) Northwest Engineering Services

5) Air Balancing Specialty Inc.

6) Precision Test & Balance, Inc.

7) Testcomm

8) American Commissioning and LEED Consultants, Inc.

2. Balance Firm Qualifications:

a. General:

1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.

2) Provide proof of testing agency having successfully completed at least five projects of similar size and scope.

b. Testing and Balancing firm is certified by NEBB or AABC and has a NEBB Certified Professional (CP) or a AABC Test and Balancer Engineer (TBE) on staff.

c. Industry Standards: Testing and Balancing will conform to NEBB or AABC, and American National Standards Institute (ANSI) as follows:

1) NEBB: Comply with Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

2) AABC: Comply with National Standards for Total System Balance.

3) ANSI:

(a) S1.4 Specifications for sound level meters.

(b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.

(c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.

d. Test Observation: If requested, conduct tests in the presence of the Commissioning Authority, AHJ, Architect or the Architect's representative.

3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).

4. Owner Witness: Perform tests in the presence of the Commissioning Authority, Architect, Architect's Representative, or Owner's representative.

5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.

6. Simultaneous Testing: Test observations by the AHJ, the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.

7. Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.

8. Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.

9. TAB Conference: Meet with the Commissioning Authority, Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.

   a. Agenda Items: Include at least the following:

      1) Submittal distribution requirements.

      2) Contract Documents examination report.

      3) TAB plan.

      4) Work schedule and Project site access requirements.

      5) Coordination and cooperation of trades and subcontractors.

      6) Coordination of documentation and communication flow.

10. Certification of TAB Reports: This certification includes the following:

    a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

    b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

11. TAB Reports: Use standard forms from NEBB or AABC.

12. Instrumentation Type, Quantity, and Accuracy: As described in NEBB or AABC.

13. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of outlet, coil, or device listed in the final TAB report.

2. Guarantee: Meet the requirements of the following programs:

a. Provide a guarantee on NEBB or AABC forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.

2) Systems are balanced to optimum performance capabilities within design and installation limits.

1.07 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. TAB: Testing, Adjusting, and Balancing.

K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

L. Test: A procedure to determine quantitative performance of a system or equipment.

M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.

N. AABC: Associated Air Balance Council.

O. NEBB: National Environmental Balancing Bureau.

P. AMCA: Air Movement and Control Association.

Q. CTI: Cooling Tower Institute.

R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.08 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.

C. Witness leakage and pressure tests carried out by Section 23 31 00, HVAC Ducts and Casings.

D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS AND PROCEDURES

A. Project Conditions:

1. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

B. General Requirements:

1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.

3. Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.

C. Examination:

1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

    a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.

    b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

2. Examine approved submittal data of HVAC systems and equipment.

3. Examine Project record documents described in Division 01, General Requirements.

4. Examine Architect's and Engineer's design data, including Basis of Design, HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

5. Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

6. Coordinate requirements in system and equipment with this Section.

7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

8. Examine system and equipment test reports.

9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

11. Examine equipment for installation and for properly operating safety interlocks and controls.

12. Report deficiencies discovered before and during performance of TAB procedures.

D. Preparation:

1. Prepare a TAB plan that includes strategies and step-by-step procedures.

2. Complete system readiness checks and prepare system readiness reports. Verify the following:

a. Permanent electrical power wiring is complete.

b. Hydronic systems are filled, clean, and free of air.

c. Automatic temperature-control systems are operational.

d. Equipment and duct access doors are securely closed.

e. Balance, smoke, and fire dampers are open.

f. Isolating and balancing valves are open and control valves are operational.

g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.

3. Hold a pre-balancing meeting at least one week prior to starting TAB work.

a. Attendance is required by installers whose work will be tested, adjusted, or balanced.

4. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

E. General TAB Procedures:

1. Perform TAB procedures on each system according to the procedures contained in NEBB or AABC and this Section.

2. Coordinate location of test probes prior to start of TAB procedures and make test probes available for Owner's tests after start of occupancy. Where required, cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:

1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.

2. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3. Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.

4. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.

G. Recording and Adjusting:

1. Field Logs: Maintain written logs including:

a. Running log of events and issues.

b. Discrepancies, deficient or uncompleted work by others.

c. Contract interpretation requests.

d. Lists of completed tests.

2. Ensure recorded data represents actual measured or observed conditions.

3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.

5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Authorized Representative, or Commissioning Agent.

3.02 PRE-CONSTRUCTION BALANCE (EXISTING SYSTEMS)

A. Pre-Construction Balance - Hydronic Systems

1. Prior to start of construction or demolition; read and record flow of hydronic systems to establish "as-found" conditions.

2. Read and record head loss and flow at existing coils, heat exchangers, air control devices, and pumps.

3. Read and record amp draw and motor data from each existing pump.

B. Report data and observations to Architect.

3.03 TEMPERATURE CONTROL VERIFICATION

A. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, equipment, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

B. Verify that controllers are calibrated and commissioned.

C. Check transmitter and controller locations and note conditions that would adversely affect control functions.

D. Record controller settings and note variances between set points and actual measurements.

E. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

F. Verify free travel and proper operation of control devices such as damper and valve operators.

G. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

H. Confirm interaction of electrically operated switch transducers.

I. Confirm interaction of interlock and lockout systems.

J. Verify main control supply-air pressure and observe compressor and dryer operations.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.04 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Examine strainers for clean screens and proper perforations.

B. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

C. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

D. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

E. Prepare schematic diagrams of systems' "as-built" piping layouts.

F. Prepare hydronic systems for TAB according to the following, in addition to the general preparation procedures specified above:

1. Open manual valves for maximum flow.
2. Check expansion tank liquid level, or air charge if bladder type.
3. Check makeup-water-station pressure gauge for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Set differential-pressure control valves at the specified differential pressure.
6. Set system controls so automatic valves are wide open to heat exchangers and coils.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

G. Calibrate waterflow measuring stations.

3.05 PUMP BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gauge heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
2. Check system resistance. With valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved. Report flow rates that are not within plus or minus 5 percent of design.
3. Verify pump-motor amperage. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Set calibrated balancing valves, if installed, at calculated presettings.

5. Measure flow at stations and adjust, where necessary, to obtain first balance. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

6. Measure flow at main balancing station and set main balancing device or adjust pump speed to achieve flow that is 5 percent greater than design flow.

7. Adjust balancing stations to within specified tolerances of design flow rate as follows:

    a. Determine the balancing station with the highest percentage over design flow.

    b. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.

    c. Record settings and mark balancing devices.

8. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

9. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.06 VARIABLE FLOW HYDRONIC SYSTEMS ADDITIONAL PROCEDURES

A. Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

B. Balance system to achieve the lowest required differential pressure for the system to minimize pump brake horsepower.

3.07 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance the primary system crossover flow first, then balance the secondary system.

3.08 COOLING TOWERS

A. Shut off makeup water for the duration of the test, and then make sure the makeup and blow-down systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser water flow to each cell of the cooling tower.

2. Measure entering- and leaving-water temperatures.

3. Measure wet- and dry-bulb temperatures of entering air.

4. Measure wet- and dry-bulb temperatures of leaving air.

5. Measure condenser water flow rate recirculating through the cooling tower.

6. Measure cooling tower pump discharge pressure.

7. Adjust water level and feed rate of makeup-water system.

3.09 PRE-BALANCE REPORTING

A. Pre-Construction Phase Report:

1. Provide a pre-construction phase TAB Plan at least 2 weeks prior to the commencement of TAB work. This report is to include:

a. A complete set of report forms intended for use on the Project, with all data filled in except for the field readings. Forms to be Project-specific.

b. Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.

c. Identification of the type, manufacturer, and model of actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.

d. A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.

B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

3.10 FINAL REPORTS

A. Report Requirements:

1. General:

a. Computer generated in PDF format and tabulated, divided, and bookmarked into sections by tested and balanced systems.

b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.

1) Include a list of the instruments used for procedures, along with proof of calibration.

c. Final Report Contents: In addition to the certified field report data, include the following:

1) Pump curves

2) Fan Curves

3) Manufacturers Test Data

4) Field test reports prepared by system and equipment installers

5) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data

B. General Report Data:

1. In addition to the form titles and entries, include the following data in the final report, as applicable:

a. Title Page

b. Name and Address of TAB Agent

c. Project Name

d. Project Location

e. Architect's Name and Address

f. Engineer's Name and Address

g. Contractor's Name and Address

h. Report Date

i. Signature of TAB Agent who Certifies the Report

j. Summary of Contents, Including the Following:

1) Design versus Final Performance

2) Notable Characteristics of Systems

3) Description of System Operation Sequence if it varies from the Contract Documents

k. Nomenclature Sheets for Each Item of Equipment

l. Data for Terminal Units, including Manufacturer, Type Size, and Fittings

m. Notes to explain why certain final data in the body of reports vary from design values.

n. Test Conditions for Fans and Pump Performance Forms, Including the Following:

1) Settings for Outside-, Return-, and Exhaust-air Dampers

2) Conditions of Filters

3) Cooling Coil, Wet- and Dry-bulb Conditions

4) Face and Bypass Damper Settings at Coils

5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter

6) Inlet Vane Settings for Variable-Air-Volume Systems

7) Settings for Supply-air, Static-pressure Controller

8) Other System Operating Conditions that affect Performance

C. System Diagrams:

1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

a. Quantities of Outside, Supply, Return, and Exhaust Airflows

b. Water Flow Rates

c. Pipe and Valve Sizes and Locations

d. Balancing Stations

D. Chillers:

1. For each chiller, include the following:

a. Unit Data: Include the following:

1) Unit Identification

2) Make and Model Number

3) Manufacturer's Serial Number

4) Refrigerant Type and Capacity in Gallons

5) Starter Type and Size

6) Starter Thermal Protection Size

b. Condenser Test Data: Include design and actual values for the following:

1) Refrigerant Pressure in PSIG

2) Refrigerant Temperature in Degrees F

3) Entering-water Temperature in Degrees F

4) Leaving-water Temperature in Degrees F

5) Entering-water Pressure in Feet of Head or PSIG

6) Water Pressure Differential in Feet of Head or PSIG

c. Evaporator Test Reports: Include design and actual values for the following:

1) Refrigerant Pressure in PSIG

2) Refrigerant Temperature in Degrees F

3) Entering-water Temperature in Degrees F

4) Leaving-water Temperature in Degrees F

5) Entering-water Pressure in Feet of Head or PSIG

6) Water Pressure Differential in Feet of Head or PSIG

d. Compressor Test Data: Include design and actual values for the following:

1) Make and Model Number

2) Manufacturer's Serial Number

3) Suction Pressure in PSIG

4) Suction Temperature in Degrees F

5) Discharge Pressure in PSIG

6) Discharge Temperature in Degrees F

7) Oil Pressure in PSIG

8) Oil Temperature in Degrees F

9) Voltage at Each Connection

10) Amperage for Each Phase

11) The kW Input

12) Crankcase Heater kW

13) Chilled Water Control Set Point in Degrees F

14) Condenser Water Control Set Point in Degrees F

15) Refrigerant Low-pressure-cutoff Set Point in PSIG

16) Refrigerant High-pressure-cutoff Set Point in PSIG

e. Refrigerant Test Data: Include design and actual values for the following:

1) Oil Level

2) Refrigerant Level

3) Relief Valve Setting in PSIG

4) Unloader Set Points in PSIG

5) Percentage of Cylinders Unloaded

6) Bearing Temperatures in Degrees F

7) Vane Position

8) Low-temperature-cutoff Set Point in Degrees F

E. Cooling Towers:

1. For cooling towers, include the following:

a. Unit Data: Include the following:

1) Unit Identification

2) Make and Type

3) Model and Serial Numbers

4) Nominal Cooling Capacity in Tons

5) Refrigerant Type and Weight in pounds

6) Water-treatment Chemical Feeder and Chemical

7) Number and Type of Fans

8) Fan Motor Make, Frame Size, rpm, and Horsepower

9) Fan Motor Voltage at Each Connection

10) Sheave Make, Size in Inches, and Bore

11) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches

12) Number of Belts, Make, and Size

13) Use pump unit data below for recirculating pump in evaporative condensers, not for system used with cooling towers. For cooling towers, use pump test data below.

b. Water Test Data: Include design and actual values for the following:

1) Entering-water Temperature in Degrees F

2) Leaving-water Temperature in Degrees F

3) Water Temperature Differential in Degrees F

4) Entering-water Pressure in Feet of Head or PSIG

5) Leaving-water Pressure in Feet of Head or PSIG

6) Water Pressure Differential in Feet of Head or PSIG

7) Water Flow Rate in gpm

8) Bleed Water Flow Rate in gpm

c. Air Data: Include design and actual values for the following:

1) Duct Airflow Rate in cfm

2) Inlet-duct Static Pressure in Inches wg

3) Outlet-duct Static Pressure in Inches wg

4) Average Entering-air, Wet-bulb Temperature in Degrees F

5) Average Leaving-air, Wet-bulb Temperature in Degrees F

6) Ambient Wet-bulb Temperature in Degrees F

F. Pumps:

1. For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.

a. Unit Data: Include the following:

1) Unit Identification

2) Location

3) Service

4) Make and Size

5) Model and Serial Numbers

6) Water Flow Rate in gpm

7) Water Pressure Differential in Feet of Head or PSIG

8) Required Net Positive Suction Head in Feet of Head or PSIG

9) Pump rpm

10) Impeller Diameter in Inches

11) Motor Make and Frame Size

12) Motor Horsepower and rpm

13) Voltage at Each Connection

14) Amperage for Each Phase

15) Full-load Amperage and Service Factor

16) Seal Type

b. Test Data: Include design and actual values for the following:

1) Static Head in Feet of Head or PSIG

2) Pump Shutoff Pressure in Feet of Head or PSIG

3) Actual Iimpeller Size in Inches

4) Full-open Flow Rate in gpm

5) Full-open Pressure in Feet of Head or PSIG

6) Final Discharge Pressure in Feet of Head or PSIG

7) Final Suction Pressure in Feet of Head or PSIG

8) Final Total Pressure in Feet of Head or PSIG

9) Final Water Flow Rate in gpm

10) Voltage at Each Connection

11) Amperage for Each Phase

G. Boilers:

1. For boilers, include the following:

a. Unit Data: Include the following:

1) Unit Identification

2) Location

3) Service

4) Make and Type

5) Model and Serial Numbers

6) Fuel Type and Input in Btuh

7) Number of Passes

8) Ignition Type

9) Burner-control Types

10) Voltage at Each Connection

11) Amperage for Each Phase

12) Flue-gas Analysis

b. Test Data: Include design and actual values for the following:

1) Operating Pressure in PSIG

2) Operating Temperature in Degrees F

3) Entering-water Temperature in Degrees F

4) Leaving-water Temperature in Degrees F

5) Number of Safety Valves and Sizes in NPS (DN)

6) Safety Valve Settings in PSIG

7) High-limit Setting in PSIG

8) Operating-control Setting

9) High-fire Set Point

10) Low-fire Set Point

11) Voltage at Each Connection

12) Amperage for Each Phase

13) Draft Fan Voltage at Each Connection

14) Draft Fan Amperage for Each Phase

15) Manifold Pressure in PSIG

H. Instrument Calibration:

1. For instrument calibration, include the following:

a. Report Data: Include the following:

1) Instrument Type and Make

2) Serial Number

3) Application

4) Dates of Use

b. Dates of Calibration

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Type 1, Glass Wool Pipe Insulation
2. Type 2, Flexible Elastomeric Pipe Insulation
3. Type 3, Calcium Silicate
4. Type 4, Cellular Glass
5. Jacketing
6. Accessories

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Installer qualifications.
2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
    a. Where indicated R-values/ratings cannot be achieved by a single layer of insulation, describe how performance requirements will be achieved.
3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

5. Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.

2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.

3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.

4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 FIRE HAZARD CLASSIFICATION

A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with the requirements of current edition of UL "Pipe and Equipment Coverings R5583 400 8.15."

C. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.01 TYPE 1, GLASS WOOL PIPE INSULATION

A. Acceptable Manufacturers:

1. Certainteed

2. Johns Manville

3. Knauf

4. Owens-Corning

B. Glass Wool: ASTM C547 Type I and IV; rigid molded, noncombustible.

1. Thermal Conductivity Value: As indicated in the insulation tables below.

2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.

C. Vapor Retarder Jacket: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.02 TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Acceptable Manufacturers:

1. Insulation:

a. Armacell LLC Armaflex

b. K-Flex

c. Or approved equivalent.

2. Glue:

a. Armacell LLC Armaflex Low VOC Adhesive

b. K-Flex

c. Or approved equivalent.

3. Paint:

a. Armacell LLC Armaflex

b. K-Flex

c. Or approved equivalent.

B. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. Thermal Conductivity Value: As indicated in the insulation tables below.

2. Maximum Service Temperature of 220 degrees F.

3. Maximum Flame Spread: 25.

4. Maximum Smoke Developed: 50 (1-inch thick and below).

5. Vapor Retarder Jacket, for over 1-inch insulation thickness: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

6. Connection: Waterproof vapor retarder adhesive as needed.

7. UV Protection: UV outdoor protective coating per manufacturer's requirements.

C. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.

D. Paint (for exterior insulation only): Nonhardening high elasticity type, specifically manufactured as protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.03 TYPE 3, CALCIUM SILICATE

A. Acceptable Manufacturers:

1. IIG (Industrial Insulation Group)

2. Or approved equivalent.

B. Hydrous calcium silicate, tested in accordance with ASTM C533 Type I with minimum of 1200 PSI at 5 percent compression. Field applied jacket, Class II. Maximum 1200 degrees F temperature limit. Thermal conductivity as indicated in the insulation tables below.

2.04 TYPE 4, CELLULAR GLASS

A. Acceptable Manufacturers:

1. Pittsburgh Corning

2. Or approved equivalent.

B. Cellular Glass Insulation: Foamglass pipe insulation fabricated in accordance with ASTM C552 and C585. Thermal conductivity as indicated in the insulation tables below.

2.05 JACKETING

A. Acceptable Manufacturers:

1. ITW Insulation Systems

2. General Insulation Company

3. Johns Manville

4. 3M

5. Or approved equivalent.

B. Insulation Jacketing Tape: 0.016-inch thick multi-layered laminate with minimum tensile strength of 149-lb/inch, minimum puncture resistance of 49 pounds per ASTM D1000, maximum emittance of 0.03 per ASTM C1371, maximum WVTR of 0.00 perm per ASTM E96, and min/max service temperature of -40 degrees F to 300 degrees F, as manufactured by 3M, VentureClad1579GCW-E.

C. PVC preformed molded insulation covers, for piping. Zeston or approved equivalent.

D. Aluminum Jacket: 0.016-inch-thick sheet, (smooth/embossed) finish, with longitudinal slip joints and 2-inch laps, die-shaped fitting covers with factory attached protective liner.

E. Stainless Steel Jacket: Type 304 stainless steel, 0.010-inch, smooth finish.

F. Canvas Jacket: UL listed fabric, 6 ounce/sq.yd., plain weave cotton treated with dilute fire retardant lagging adhesive.

2.06 ACCESSORIES

A. Acceptable Manufacturers:

1. ITW Insulation Systems

2. Or approved equivalent.

B. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.

C. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

D. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water-soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Verification of Conditions:

1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed.

2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.

C. Installation:

1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.

2. Piping and Equipment:

a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.

D. Provide accessories as required. See Part 2 Article "Accessories" above.

E. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

F. Labeling and Marking: Provide labels, arrows and color on piping and ductwork. Attach labels and flow direction arrows to the jacketing per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

G. Insulated Pipe Exposed to Weather: Where piping is exposed to weather, cover insulation with aluminum jacketing. Seal jacketing watertight per manufacturer's recommendations. Install metal jacketing with 2-inch overlap at longitudinal and butt joints with exposed lap pointing down. Secure jacketing with stainless-steel draw bands 12-inches on center and at butt joints.

H. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2-inches and larger (hot and cold) piping.

I. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Conductivity Range (Btu-inch per hour per SF per degrees F)	Pipe Size (Inches)	Insulation Thickness (Inches)
Heating, Steam, and Steam Condensate (141F to 200F)	1, 4	0.25-0.29 at a mean rating temperature of 125 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	1.5 1.5 2.0 2.0 2.0
Heating, Steam, and Steam Condensate (105F to 140F)	1, 4	0.22-0.28 at a mean rating temperature of 100 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	1.0 1.0 1.5 1.5 1.5
Chilled Water (40F to 60F)	1, 4	0.21-0.27 at a mean rating temperature of 75 degrees F	<1 1 to <1.5 1.5 to <4	0.5 0.5 1.0

			4 to <8 >= 8	1.0 1.0
Heating Water Storage and Air Separation Tanks	2,	0.24-0.28 at a mean rating temperature of 75 degrees F	N/A	2.0
Chilled Water Storage and Air Separation Tanks	2	0.24-0.28 at a mean rating temperature of 75 degrees F	N/A	1.0
Condenser Water (Exterior)	1, 2	0.21-0.27 at a mean rating temperature of 75 degrees F	1 to 6 >=8	1.0 1.5

1. Note: Insulation thickness shown is a minimum. If state code requires additional thickness, then provide insulation thickness per code requirements.

3.02 TYPE 1, GLASS WOOL PIPE INSULATION

A. See General Installation Requirements above.

B. Install insulation in conformance with manufacturer's recommendations and requirements.

C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

3.03 TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Flexible Elastomeric Insulation:

1. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and below grade with two coats of finish as recommended by manufacturer.

B. Flexible Elastomeric Tubing:

1. Flexible Elastomeric Tubing: Slip insulation over piping or, if piping is already installed, slit insulation and snap over piping. Joints and butt ends must be adhered with 520 adhesive.

C. See General Installation Requirements above.

D. Install insulation in conformance with manufacturer's recommendations and requirements.

E. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

F. Install in accordance with manufacturer's instructions for below grade installation.

3.04 TYPE 3, CALCIUM SILICATE

A. Install in accordance with manufacturer's instructions. Seal canvas jacket tight to insulation at lap joints. Continuous insulation over pipe, fittings and supports or hangers. No gaps permitted.

B. See General Installation Requirements above.

C. Install in accordance with manufacturer's instructions for below grade installation.

3.05 TYPE 4, CELLULAR GLASS

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Foamglass Insulation: Install in accordance with manufacturer's instructions for below grade installation and exposed weather installation with jacketing.

D. Install in accordance with manufacturer's instructions for below grade installation.

3.06 JACKETING

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

3.07 ACCESSORIES

A. Install insulation in conformance with manufacturer's instructions, recommendations and requirements.

B. See General Installation Requirements above.

C. Furnish and install accessories for all insulation types listed in this Section.

END OF SECTION

SECTION 23 11 13 - FACILITY FUEL - OIL PIPING AND SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Fuel Pipe and Pipe Fittings
2. Fuel-Oil Valves
3. Fuel-Oil Return Pump
4. Fuel-Oil Day Tank
5. Fuel-Oil Piping and Specialty Products

B. Contractor to coordinate and provide all interconnecting piping, conduits, fittings, etc., between suppliers equipment and devices for complete and operating system.

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 26, Electrical requirements for grounding fuel piping systems.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Qualifications: Firms with a minimum of five years' experience and regularly engaged in manufacture and/or installation of fuel-oil burning equipment and fuel-oil system products of types, materials, and sizes required.
2. Provide complete fuel oil handling and dispensing systems including the pump set, control cabinet, tank, tank gauging, and accessories supplied by one original equipment manufacturer (OEM). OEM has employees who manufacture, design, start up and service fuel oil handling systems of this nature throughout the United States. Proof of manufacturing and starting up of the specified system(s) within the last five years must be

supplied. This is to assure the highest standards of product quality and system integration capabilities for the customer.

3. Comply with the current edition of the following regulatory requirements as well as all References and Standard specified in Section 23 00 00, HVAC Basic Requirements:

    a. NFPA Compliance: Install fuel systems in accordance with:

        1) NFPA 31, Standard for the Installation of Oil Burning Equipment.

        2) NFPA 30, Flammable and Combustible Liquids Code.

    b. UL Compliance:

        1) UL 567, Pipe Connectors for Flammable and Combustible Liquids and LP Gas.

        2) UL 79, Power Operated Pumps for Petroleum Product dispensing Systems.

        3) UL 971, Standard for Nonmetallic Underground Piping for Flammable Liquids.

        4) UL 842, Standard for Safety for Valves for Flammable Fluids.

        5) UL 2085, Standard for Fire Resistance of Steel Aboveground Tanks for Flammable and Combustible Liquids.

        6) UL 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids.

        7) UL 508, Standard for Safety of Industrial Control Equipment.

    c. UFC Compliance (Oregon Administrative Rules 837, Division 40):

        1) Article 79, "Flammable and Combustible Liquids."

        2) Appendix II-B, "Protection of Flammable and Combustible Liquid Tanks in Locations Subject to Flooding."

    d. UFC Compliance (Washington Administrative Code 51-44):

        1) Article 61, "Oil-burning Equipment."

        2) Article 79, "Flammable and Combustible Liquids."

        3) Appendix II-J, "Storage of Flammable or Combustible Liquids in Tanks Located within Below Grade Vaults."

    e. IMC Compliance: Fabricate and install fuel systems in accordance with IMC, Chapter 13 "Fuel-Oil Piping and Storage."

    f. CGA Compliance: CGA 3.16, "Lever Operated Non-Lubricated Gas Shut-Off Valves."

    g. FM Global Compliance:

        1) Provide fuel-oil system products that are listed by FM Global as acceptable.

2) FM Global Property Loss Prevention Data Sheet 7-88, "Storage Tanks for Flammable and Combustible Liquids."

4. Submit a complete, project-specific submittal package containing scale drawings of piping layout and components, complete bill of materials, control cabinet layouts, sequence of operations, electrical wiring diagrams, catalog data and proof of product liability insurance. Partial submittals not accepted. Drawings and product information are to be project specific. Catalog cuts or "standard drawings" not acceptable.

5. Product Data: Submit manufacturer's technical product data and installation instructions for fuel system materials and products, instrumentation, and leak detection systems.

   a. Provide submittals for piping, safety devices, fill port, day tank, and any other products required to provide complete working system together with their listed regulatory compliance.

   b. List regulatory compliance of submitted products to applicable construction standards.

   c. Submit copies of product warranties applicable to products specified in this Section.

   d. Submit manufacturer's shop drawings for day tank. Include dimensions and locations of fittings and accessories. Indicate locations for related electrical equipment, control panels, and electrical enclosures.

   e. Provide submittals for electrical products required to provide complete working system together with their listed regulatory compliance. Products provided will be suitable for installation in hazardous locations as defined by NFPA 70, National Electrical Code. Provide electrical enclosures with NEMA ratings appropriate for their installed use.

6. Record Drawings: At project closeout, submit Record Drawings of installed piping, oil storage tanks, and fuel systems products.

7. Maintenance Data: Submit maintenance data and parts list for fuel systems materials and products. Include this data, product data, shop drawings and Record Drawings in maintenance manual.

8. Substitutions: Where items of equipment and/or materials are specifically identified by a manufacturer's name or model number, such specified items may be used in the base bid. If the contractor wishes to utilize equipment other than that specifically named in the base bid, they must submit a request in writing, together with the full description and technical data on the equipment proposed as listed in Division 01, General Requirements for substitutions. If such equipment is accepted as an alternate, bidders will be notified to allow them to include the accepted equipment. It is further understood that the substitution(s) are to include modifications or extra cost(s), regardless of the trade(s) involved, or changed necessary due to the alternate equipment. Submittal or shop drawings, if other than the base named equipment, must show detailed changes required by other trades involved. Contractor is responsible for additional costs involved. Under no circumstances are the Architect or Engineer responsible for the installation, operation, or performance of substitute materials or equipment, even though accepted; this is the sole responsibility of the contractor. In addition to specific warranty in the heating, ventilating, air conditioning, plumbing, or electrical Specifications, the manufacturers of equipment to be supplied under any substitution warrant the same against costs, including labor and material, arising out of

defects in material and/or workmanship, for a period coextensive with the guarantee period provided in the Contract Documents.

9. The calculation of capacities, quantities, dimensions, and other attributes are based on the pertinent data of the Base Name Manufacturers. If submitted alternate manufacturer is accepted as an alternate, it is the contractor's responsibility to investigate in detail the products of these other manufacturers. The contractor is solely responsible for changes in design, location, dimension, function, and installation involved in selection of other than the Base Named Manufacturer. The contractor is responsible for, and bears costs for, changes including required work of other trades, or the Owner and including the Architect's and Engineer's redesign or evaluation of submittal costs caused directly or indirectly by the use of equipment other than that listed on the Drawings or called for in the Specifications.

10. Factory Testing:

    a. Prior to shipment, manufacturer tests "packaged" assemblies. Owner and/or consulting engineer at their discretion to observe this and other tests.

    b. Electrical components functionally tested with instruments and controls. Settings of instruments and controls verified for conformance to these Specifications. A certificate of factory testing, together with a copy of the wiring diagram to be placed in the control cabinet prior to shipment. Affix UL-508 label to the inside of the cabinet.

11. Installation, Startup, Training, and Service:

    a. Installation in strict accordance with manufacturer's instructions.

    b. The contractor provides the services of the manufacturer's technician to monitor the installation, start-up, test and calibrate the equipment. The manufacturer's technician also provides training. The fuel handling system as a whole is functionally tested. Instrument settings verified for conformance to these Specifications.

    c. Provide one day of factory certified service for the startup and certification of the fuel oil handling system and fuel management system (FMS). Provide for one 8-hour training session in the proper operation and maintenance of the equipment. Training sessions cover the operation, troubleshooting and maintenance of the fuel-handling equipment and FMS. Installing contractor will not waive this requirement. Provide a letter from the fuel oil handling system manufacturer and FMS manufacturer to the consulting engineer and Owner stating that the system received its factory startup and that components are in working order.

    d. Training session for the fuel oil handling system to include its integration with the FMS. Provide training on same day as FMS training, unless otherwise directed by Owner.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fuel Pipe and Pipe Fittings:

1. Steel Pipe:

a. Schedule 40 black steel.

B. Fuel-Oil Valves:

1. Equipment Isolation Ball Valves:

a. Nibco, Model T-585-70-UL (1/4-inch to 1-inch).

b. Or approved equivalent.

2. Sectional Isolation Ball Valves

a. Nibco, Model T-595Y-70-UL (1/4-inch to 2-inch).

b. Or approved equivalent.

3. Anti-Siphon Valve:

a. See Fuel Handling Equipment Schedule.

b. Or approved equivalent.

4. Foot Valve:

a. See Fuel Handling Equipment Schedule.

b. Or approved equivalent.

5. Fuel Oil Fusible Valves:

a. Globe Valve:

1) See Fuel Handling Equipment Schedule.

2) Or approved equivalent.

6. Fuel Oil Solenoid Valve:

a. See Fuel Handling Equipment Schedule.

b. Or approved equivalent.

C. Fuel-Oil Return Pump:

1. See Fuel Handling Equipment Schedule.

2. Or approved equivalent.

D. Fuel-Oil Day Tank:

1. See Fuel Handling Equipment Schedule.

2. Or approved equivalent.

E. Fuel-Oil Piping and Specialty Products:

1. Level Gauge:

a. See Fuel Handling Equipment Schedule.

b. Or approved equivalent.

2. Vent Caps:

a. See Fuel Handling Equipment Schedule.

b. Or approved equivalent.

2.02 FUEL PIPE AND PIPE FITTINGS

A. Steel Pipe (Above Grade Installations and in containment vessels or etc.): ASTM A53, electric-resistance welded (Type E) or seamless (Type S), Grade B, black, Schedule 40 pipe, manufactured for threaded or welded pipe connections.

B. Fittings for Steel Pipe (Above Grade Installations):

1. General: Mark fittings, unions, and other products recognized as regularly available products in accordance with MSS SP-25. Marking on products of small size or shape may be omitted in sequence allowed by MSS SP-25, except for manufacturer's name or trademark.

2. Threaded Fittings: Conforming to ANSI B2.1, ASTM A47, 150 PSI rating, except where otherwise specified, or prevailing codes or requirements dictate use of 300 PSI ratings. Fittings to be fabricated from standard malleable iron with dimensions conforming to ANSI B16.3.

3. Unions: Conform to ANSI B16.39, ASTM A47 and fabricated from malleable iron with bronze-to-iron ground joints rated at 150 percent design operating pressure. Threads to conform to ANSI B2.1.

4. Threaded Pipe Plugs: Conforming to ANSI B16.14.

5. Thread Lubricant: Meet or exceed AGA No. 4-90 rating and compliant with Federal Specification TT-S-1732, manufactured compatible with fuel oil.

C. Pipe Supports:

1. Support spacing determined by the manufacturer based on pipe diameter, pipe materials, and operating temperature of the product pipes.

2.03 FUEL-OIL VALVES

A. General Requirements: Valve products provided for use with fuel-oil systems UL 842 listed. Additional valve standards and valve construction standards are listed specific to type of valve specified.

B. Equipment Isolation Ball Valves:

1. Pipe 2-1/2-inches and Smaller: AGA/CGA 3.16-M88, and ASME B16.33 compliant, two-piece, bronze body, non-lubricated, threaded connections, full-port ball valves. Rated for 125-PSIG maximum pressure.

C. Sectional Isolation Ball Valves:

1. Pipe 2-1/2-inches and Smaller: MSS SP-110, and ASME B16.33 compliant, three-piece, bronze body, non-lubricated, threaded connections, full-port ball valves. Rated for 250-PSIG maximum pressure.

D. Anti-Siphon Valve:

1. Furnish and install at the high point of the oil suction line a UL-listed and labeled anti-siphon valve. Valves that do not have an Underwriters Laboratory certification, listing and label and do not conform to local, state and federal fire codes not acceptable. The anti-siphon valve reduces fire hazards and prevents oil spills caused by oil being siphoned from the storage tank onto the equipment room floor. The valve automatically shuts off the oil flow in the event of a broken or inadvertently left open oil suction line. In the event of a fire, to avoid thermal expansion induced valve failure the anti-siphon valve body material must be bronze. Anti-siphon valves supplied with cast iron bodies or without a UL labels to be removed and a UL-certified bronze body valve will be installed at the contractor's expense. Valve sized to meet the flow and vertical pipe height requirements of the system.

E. Foot Valve:

1. Double Poppet Foot Valves: If the top of the tank is located below the centerline of the pump, furnish and install on the tank suction stub a bronze double poppet foot valve of bronze construction, with lapped-in seats, flat poppets and 20 mesh monel screen. Furnish and install at the tank suction stub exit the foot valve extractor fitting.

2.04 FUEL-OIL DAY TANK

A. General Description: Provide packaged design fuel oil day tank for each boiler as indicated in Drawings. Day tank complete in order to provide for reliable, local source of fuel. Specifically design day tank for use with remote storage tank. Day tank automatically self-refilling and equipped for unattended operation. Day tank includes accessories as detailed to prevent overflow and allow for overflow-return to remote storage tank. Day tank to be product of manufacturer regularly engaged in manufacture of standard, serial production line of day tanks.

B. Provide UL 142 listed tank for Class II combustible liquid and furnish with interior and exterior epoxy coating for corrosion protection.

C. Tank fitting connections to include, but not limited to following:

1. Vents required per UL 142 and NFPA 30.

2. Inlet from supply drop tube.
3. Supply to boiler drop tube.
4. Return from boiler.
5. Pump supply to day tank drop tube.
6. Overflow return to remote storage tank drop tube.
7. Manual fill port with lockable cap and drop tube.

D. Day tank to be equipped with UL 508 listed automatic level controller.

1. Control Functions to include, but not limited to the following:
    a. "Auto-off manual" pump controller
    b. Pump test push-button
    c. Pump start-stop automatic level differential control
    d. Pump over controller
    e. Overflow-return pump test push-button
    f. Overflow-return pump automatic level differential control.
2. Indication Functions to include, but not limited to the following:
    a. Fuel Level
    b. Power available
    c. Switch not in auto
    d. Pump running
    e. Low level alarm
    f. High level alarm
    g. Overflow alarm/pump control activated
    h. Overflow-return pump armed
    i. Overflow-return pump running
    j. Tank leak
3. Alarm Outputs to include, but not limited to the following:
    a. Tank leak alarm
    b. Low level alarm

c. High level alarm

4. Level controller has intrinsic overflow cutout backup control switch which upon sensing an overflow, will stop pump, activate an alarm, and cause controller to revert to emergency backup level control mode, allowing tank to continue operating automatically in manner preventing overflow. Upon activation of overflow alarm, start overflow-return pump and pump-down tank to 70 percent level.

5. Overflow-return Pumps:

   a. Positive displacement, high vacuum suction pump suitable for transferring fuel oil via suction lift of not less than 20-feet. Pump: Non-corrosive construction and equipped with leak resistant mechanical rotary shaft seal. Driven by an electric motor, close-coupled, direct drive, via self-aligning shaft coupling. Motor: 1725 RPM, continuous duty 40C ambient, Class B insulation, UL listed, with integral overload protection.

   b. Equip overflow-return pump with one-way check valve and automatic-closing, fusible link valve, ductile construction, 165F fuse.

6. Inlet Flow Control to include, but not limited to the following:

   a. Solenoid valve rated for 100-PSIG.

   b. Fuel strainer to protect solenoid.

   c. Bronze bodied manual isolation valve rated for 600-PSIG.

   d. Automatic-closing, fusible link valve, ductile construction, 165F fuse.

7. On outlet to engine or boiler, provide an automatic-closing, fusible link valve, ductile construction, 165F fuse.

8. Provide exterior vent caps for vents, sized per NFPA 30 requirements.

9. Day tanks provided for use with aboveground storage tanks (AST) provided with carbon steel, fire-rated isolation valve, automatic-closing, fusible link valve, ductile construction, 165F fuse, and siphon-break, normally-open solenoid valve operated by day tank level controller.

10. Provide day tank with factory options as indicated in Drawings.

11. Provide day tank with minimum 2-year warranty covering materials and service labor.

12. Provide one day of start-up service by a factory service technician or factory authorized local service technician.

2.05 FUEL-OIL PIPING AND SPECIALTY PRODUCTS

A. Level Gauge: Magnetic type.

B. Foot Valves: Provide on oil suction line, foot valve consisting of bronze body, single poppet with metal-to-metal seat, and Monel screen. Select for type fuel and full size of oil suction piping.

C. Vent Caps: Provide vent cap on top of each oil piping vent line, consisting of aluminum or bronze housing, 40 mesh screen, and rain shedding top. Select full size of vent pipe.

D. Foot Valve:

1. Foot valve extractor assembly to include screen, double poppet foot valve, foot valve extractor fitting and pipe cap.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Inspection: Examine areas and conditions under which fuel systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Identification: Install mechanical identification in accordance with Section 23 05 53, HVAC Identification.

C. Comply with basic requirements of Section 23 00 00, HVAC Basic Requirements. Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each route with minimum of joints and couplings, but with adequate and accessible unions or flanges for disassembly, maintenance, and replacement of valves and equipment. Reduce sizes by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance. Comply with current edition of ANSI B31.9 Code for Pressure Piping.

D. Installed piping not to interfere with maintenance of equipment, opening of doors or other moving parts nor be directly above or near any portion of electrical equipment.

E. Support piping such that connected equipment does not bear weight of piping.

F. Adequately support vertical lines at their bases or by suitable hanger placed in horizontal line near riser or, preferably, by base fitting set on a pedestal.

G. Piping not to be suspended or supported by pumps. Apply no torque to pumps by connecting pipes. After final pipe adjustments and initial operational verification of pumps, recheck alignment of pumps and realign as required.

H. Ream steel pipes after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods for opening and closure.

I. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.

J. Threading: Thread steel pipe in accordance with current edition of ANSI B21.1 with standard right hand threads. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or proper pipe joint tape where recommended by pipe/fitting manufacturer on male threads at each joint and tighten joint to leave not more than three threads exposed.

K. Sealants: Use sealants on metal fuel piping threads which are chemically resistant to fuel. Use sealants sparingly and apply only to male threads of metal joints.

L. Cleaning, Start-Up, Painting and Adjustment:

1. Clean exterior surfaces of installed systems of superfluous materials, and prepare for application of painting, or coatings, if any. Comply with preparation requirements of Section 23 05 53, Identification for HVAC Piping and Equipment and Section 23 00 00, HVAC Basic Requirements. Flush out other piping systems with dry air or nitrogen after completing required tests. Inspect each segment of each system for completion of joints, supports and accessory items.

2. Inspect piping in accordance with the procedures of current edition of ANSI B31.9.

3. Fill: Upon completion of installation, fill storage tank to capacity with No. 2 grade diesel oil conforming to all EPA, Federal, State and local regulations. After completion of successful generator testing, refill tank to capacity.

4. Paint piping exposed to weather with one coat of Rustoleum.

M. Equipment Connections: Connect fuel piping to oil tank and oil-burning equipment as indicated, and in accordance with applicable codes.

3.02 FUEL PIPE AND PIPE FITTINGS

A. General:

1. Reference 3.01, General Installation Requirements.

2. Install per manufacturer's instructions and recommendations.

B. Black Steel:

1. Reference 3.01 General Installation Requirements; install per local code.

2. Pressure test system to 100 psig for 24 hours.

C. Fuel Piping Installation:

1. Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each route with a minimum of joints and couplings, but with adequate and accessible unions for disassembly, maintenance, and replacement of valves and equipment. Reduce sizes by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance. Comply with ANSI B31.9 Code for Pressure Piping. Provide shutoff valves, pressure regulators and unions at connections to fuel-fired equipment. Provide dirt legs at low points.

2. Installed piping not to interfere with maintenance of equipment, opening of doors or other moving parts nor be directly above or near any portion of electrical equipment.

3. Support piping such that connected equipment does not bear weight of piping.

4. Adequately support vertical lines at their bases or by suitable hanger placed in horizontal line near riser or, preferably, by base fitting set on a pedestal.

5. Piping Through Roof: Coordinate roof penetrations prior to installation of piping. Coordinate location with roof structure and roof mounted equipment.

6. Ream steel pipes after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods for opening and closure.

7. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.

8. Threading: Thread steel pipe in accordance with ANSI B21.1 with standard right hand threads. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or proper pipe joint tape where recommended by pipe/fitting manufacturer on male threads at each joint and tighten joint to leave not more than three threads exposed.

9. Sealants: Use sealants on metal fuel piping threads which are chemically resistant to fuel. Use sealants sparingly and apply only to male threads of metal joints.

10. Maintain electrically continuous piping system; provide grounding jumper where required to maintain continuity. Provide grounding connection; install per requirements of Division 26, Electrical.

11. Install dirt legs in fuel piping where indicated and where required by code or regulation. Do not rest dirt leg on surface of roof, floor or deck.

12. Piping: Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.

3.03 FUEL-OIL VALVES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Prepare Valves for Shipping as Follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces and weld ends.

3. Set ball valves open to minimize exposure of functional surfaces.

D. Use the Following Precautions During Storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

E. Do not attempt to repair defective valves; replace with new valves.

3.04 FUEL-OIL RETURN PUMP

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.05 FUEL-OIL DAY TANK

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Comply with applicable provisions of current edition of NFPA 30 and 31, except as otherwise indicated.

D. Oil Tank Pitch: Pitch bottom of oil tank 3-inches for entire length, with fill opening at low end.

E. Anchor tank to concrete pad.

F. Antisiphon Valves: When oil tank is located above oil burner, install oil antisiphon valve at high point of oil suction line piping.

3.06 FUEL-OIL PIPING AND SPECIALTY PRODUCTS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Foot Valves: Install in fuel suction line, 6-inches above tank bottom.

D. Vent Caps: Install on top of each vent pipe in location shown on Drawings and elevations, and as required by code.

END OF SECTION

SECTION 23 11 23 - FACILITY FUEL - NATURAL GAS PIPING AND SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Fuel Pipe and Pipe Fittings - General
2. Steel Pipe and Fittings, Above Grade
3. Natural Gas Valves
4. Natural Gas Pressure Regulators
5. Gas Solenoid Valves
6. Flexible Pipe Connectors - Gas Piping (CSA Listed)

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 26, Electrical requirements for grounding fuel piping systems.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fuel Pipe and Pipe Fittings - General:

1. Flange Gaskets:

a. Buna-N (Nitrile)

b. NBR

c. Viton

d. Or approved equivalent.

B. Steel Pipe and Fittings, Above Grade:

1. American Piping Products

2. US Steel

3. Or approved equivalent.

C. Natural Gas Valves:

1. Apollo

2. Jenkins Bros.

3. Lunkenheimer Co.

4. Nibco

5. Watts

6. Or approved equivalent.

D. Natural Gas Pressure Regulators:

1. Maxitrol

2. Equimeter

3. Or approved equivalent.

E. Gas Solenoid Valves:

1. ASCO Red Hat Series 8210 and 8030. Specific model numbers scheduled on Drawings.

2. Or approved equivalent.

F. Flexible Pipe Connectors - Gas Piping (CSA Listed):

1. Dormont

2. Proflex

3. Or approved equivalent.

2.02 FUEL PIPE AND PIPE FITTINGS - GENERAL

A. Flange Gaskets: Gaskets to be constructed from elastomeric materials.

B. Install per manufacturer's recommended installation requirements.

2.03 STEEL PIPE AND FITTINGS, ABOVE GRADE

A. Steel Pipe (Above Grade Installation):

1. ASTM A53, electric-resistance welded Type E, Grade B black pipe, manufactured for threaded pipe connections.

   a. 2-inches and Smaller: Schedule 40, ASTM A53 black steel pipe and black malleable threaded fittings.

   b. 2-1/2-inches and Larger: Schedule 40, ASTM A53 black pipe with butt weld fittings.

B. Fittings for Steel Pipe (Above Grade Installations):

1. General: Mark fittings, unions, and other products recognized as regularly available products in accordance with MSS SP-25. Marking on products of small size or shape may be omitted from sequence allowed by MSS SP-25, except for manufacturer's name or trademark.

2. Threaded Fittings: Conforming to ANSI B2.1, ASTM A47, 150 PSI rating, except where otherwise specified or prevailing codes or requirements dictate use of 300 PSI ratings. Fittings to be fabricated from standard malleable iron with dimensions conforming to ANSI B16.3.

3. Welded Fittings: Wrought carbon steel fittings, ASTM A234, ANSI B16.9, B16.28. Butt-welding type unless otherwise indicated to be socket welding type.

4. Flanges: Carbon steel conforming to ASTM A105, ANSI B16.5, and factory forged in USA. Flanges which have been machined, remade, painted, or are non-domestic origin are not acceptable. Provide raised or full face ends wherever indicated or required.

5. Flange Gaskets: Gaskets to be constructed from elastomeric materials.

6. Flange Hardware: Bolting materials to be corrosion resistant carbon steel bolts and hex nuts conforming to ASTM A307. Provide bolting materials used in containment sumps below grade applications, stainless steel bolts and hex nuts conforming to ASTM A453. Threads and dimensions to be in accordance with ANSI B1.1 and B18.2.

7. Unions: Conform to ANSI B16.39, ASTM A47 and fabricated from malleable iron with bronze-to-iron ground joints rated at 150 percent design operating pressure. Threads to conform to ANSI B2.1.

8. Threaded Pipe Plugs: Conforming to ANSI B16.14.

9. Thread Lubricant: Meet or exceed CGA ratings and compliant with Federal Specification TT-S-1732, manufactured compatible with fuel oil.

2.04 NATURAL GAS VALVES

A. 2-inches and Smaller: MSS SP-110 ball valves constructed in compliance with ASME B16.33. UL listed, FM approved, two-piece construction, threaded, bronze or brass body, full port, chrome plated brass ball, blowout-proof stem design, 125 PSI WOG working pressure.

B. 2-1/2-inches and Larger: 100 to 125 PSI rated, all bronze or iron body/bronze trimmed plug cock type, square head or tee/lever handle operation. CSA listed.

2.05 NATURAL GAS PRESSURE REGULATORS

A. Natural Gas: Diaphragm and spring actuated type, with ventless or vented relief feature. Construction, pressure range and venting features suitable for intended service. Regulator to meet code and serving utility requirements. Pipe vented type to atmosphere in approved location.

2.06 GAS SOLENOID VALVES

A. General: Solenoid bodies will be brass construction with NPT ports. The valves will be "normally closed" and pilot operated or direct acting depending on application.

B. Electrical: 125V/1ph/60Hz.

C. Internal Construction: Type 304 and Type 316 internal parts, elastomeric seals and lubricants as appropriate for gas service.

2.07 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED)

A. Inner Hose: Type 304 stainless steel.

B. Exterior Sleeve: Braided, Type 304 stainless steel.

C. Pressure Rating: 175 PSI at 70 degrees F up to 4-inch pipe.

D. Joint: Threaded carbon steel.

E. Maximum Offset: 3/4-inch on each side of installed center line.

F. Flexible Connectors: Flexible connectors used in LP and LPG piping systems compliant with following:

1. Install in accordance with manufacturer's instructions.

2. Flexible connectors and hose used as flexible connectors not exceed 3-feet in length where used with liquid or vapor piping on portable or stationary tanks.

3. Hose permitted to be used if flexibility is required for liquid or vapor transfer.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Inspection: Examine areas and conditions under which fuel systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Identification: Install mechanical identification in accordance with Section 22 05 53, Identification for Plumbing Piping and Equipment.

C. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

D. Remove scale and dirt on inside and outside before assembly.

E. Prepare piping connections to equipment with flanges or unions.

F. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.

G. Install piping systems in accordance with manufacturer's instructions.

H. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

I. Install piping to conserve building space and avoid interference with use of space.

J. Sleeve pipe passing through partitions, walls, and floors.

K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

L. Provide piping mains, branches and runouts installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Provide stresses within allowable limits of ANSI B31.1 for pressure piping.

M. Equipment Connections: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions. Flexible connections where required per ASCE 7-16 or shown on Drawings.

N. Piping Tests: Test natural gas piping in accordance with applicable mechanical code requirements, ANSI B31.2, and local utility requirements at a minimum of 100 psig for 24 hours.

3.02 FUEL PIPE AND PIPE FITTINGS - GENERAL

A. Black Steel: See 3.01 General Installation Requirements above and install per local code pressure test system to 100 psig for 24 hours.

B. Fuel Piping Installation:

1. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each route with a minimum of joints and couplings, but with adequate and accessible unions or flanges for disassembly, maintenance, and replacement of valves and equipment. Reduce sizes by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance. Comply with ANSI B31.9 Code for Pressure Piping. Provide shutoff valves, pressure regulators and unions at connections to gas-fired equipment. Provide dirt legs at low points.

2. Installed piping not to interfere with maintenance of equipment, opening of doors or other moving parts nor be directly above or near any portion of electrical equipment.

3. Support piping such that connected equipment does not bear weight of piping.

4. Adequately support vertical lines at their bases or by suitable hanger placed in horizontal line near riser or, preferably, by base fitting set on a pedestal.

5. Piping Through Roof: Coordinate roof penetrations prior to installation of piping. Coordinate location with roof structure and roof mounted equipment.

6. Ream steel pipes after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods for opening and closure.

7. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.

8. Threading: Thread steel pipe in accordance with ANSI B21.1 with standard right hand threads. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or proper pipe joint tape where recommended by pipe/fitting manufacturer on male threads at each joint and tighten joint to leave not more than three threads exposed.

9. Sealants: Use sealants on metal fuel piping threads which are chemically resistant to fuel. Use sealants sparingly and apply only to male threads of metal joints.

10. Maintain electrically continuous piping system; provide grounding jumper where required to maintain continuity. Provide grounding connection; install per requirements of Division 26, Electrical.

11. Install dirt legs in gas piping where indicated and where required by code or regulation. Do not rest dirt leg on surface of roof, floor or deck.

12. Support gas piping above roof on preformed pipe stands. Guide pipes with clamp one size larger than pipe. Provide supports at intervals per code manufacturer, and details and at each change in direction. Wood blocks are not approved supports.

13. Gas Regulator Vent Piping: Provide Schedule 40, A53 black steel pipe and threaded black malleable threaded fittings for vent piping. Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.

14. Piping: Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.

3.03 STEEL PIPE AND FITTINGS, ABOVE GRADE INSTALLATION

A. See 3.01 General Installation Requirements above and install per current version of manufacturer's installation guidelines. Test system in accordance with requirements of local code and ANSI LC-1.

3.04 NATURAL GAS VALVE INSTALLATION

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces and weld ends.

3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Do not attempt to repair defective valves; replace with new valves.

D. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.

E. Locate gas valves where easily accessible and protected from possible damage.

3.05 NATURAL GAS PRESSURE REGULATORS INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.

B. Vent regulators to outdoors as required.

C. Pressure Regulating Valves: Install as required at gas-fired appliances; comply with utility/code requirements. Pipe atmospheric vent to outdoors, full size outlet with 90 degree elbow downturn. Install gas shutoff valve upstream of each pressure regulating valve. Install in accordance with manufacturer's instructions to prevent freezing.

3.06 GAS SOLENOID VALVES INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.

B. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.

C. Locate gas valves where easily accessible and protected from possible damage.

3.07 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED) INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.

END OF SECTION

SECTION 23 21 13 - HVAC PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Hydronic Piping, Above Grade
2. Equipment Drains and Overflows
3. Unions

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Welding Certificates: Copies of certificates for welding procedures and personnel.
2. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Failed test results and corrective action taken to achieve requirements.
3. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at project site.
4. Grooved couplings, fittings, valves, and specialties: Show grooved joint couplings and fittings on Shop Drawings and product submittals, and specifically identify with the applicable coupling style number.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with documented experience.

2. Welder Qualifications: Certify in accordance with ASME (BPV IX).

3. ASME Compliance: Comply with ASME B31.9 "Building Services Piping" for materials, products, and installation. Provide safety valves and pressure vessels with the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.

4. Grooved couplings, fittings, valves, and specialties: Provide all grooved couplings, fittings, valves, and specialty products from a single manufacturer. Utilize only grooving tools from the same manufacturer as the grooved components. Date-stamp all castings used for couplings housings, fittings, or valve and specialty bodies for quality assurance and traceability.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. Grooved Couplings, Fittings, Valves, and Specialties:

1. Provide warranty directly to Owner from the grooved product manufacturer for a period of not less than 30 years with the following coverage:

a. Labor, material, and costs to repair or replace any warranted product and any part of the mechanical system(s) damaged as a direct result of the failure of a warranted product.

b. Labor, material, and costs to repair or replace building components (such as ceiling tiles, sheetrock, paint, flooring materials, etc.) damaged as a direct result of the failure, repair, or replacement of a warranted product.

PART 2 - PRODUCTS

2.01 HYDRONIC PIPING, ABOVE GRADE

A. Grooved Mechanical Joint Fittings for Chilled Water and Condenser Water Only: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47 (ASTM A47M), Grade 32510 malleable iron; ASTM A53, Type F, E, or S, Grade B fabricated steel; or, ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.

1. Grooved Mechanical-Joint Couplings: Ductile or malleable iron housing and synthetic rubber gasket of central cavity pressure-responsive design for operating temperature range from -30 degrees F to 230 degrees F. Gasket material as recommended by manufacturer for design conditions.

a. Manufacturers - Grooved Mechanical Joint Fittings and Couplings:

1) Anvil International

2) Shurjoint Piping Products

3) Victaulic

B. Steel Pipe:

1. Sizes 10-inches and Under: ASTM A 53/A 53M, Schedule 40, black, Type E (electric resistance welded), Grade B.

a. Fittings: ASME B16.3, malleable iron or ASTM A 234/A 234M, wrought steel welding type.

b. Wrought Cast and Forged Steel Flanges and Flanged Fittings: ASME B16.5 including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1) Material Group: 1.1.

2) End Connections: Butt welding.

3) Facings: Raised face.

c. Joints: Threaded or AWS D1.1 welded.

2. Pipe Sizes 12-inch and Over: ASTM A 53/A 53M, 0.375-inch wall, black.

a. Fittings: ASTM A 234/A 234M, wrought steel welding type.

b. Wrought Cast and Forged Steel Flanges and Flanged Fittings: ASME B16.5 including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1) Material Group: 1.1.

2) End Connections: Butt welding.

3) Facings: Raised face.

c. Joints: Welded in accordance with AWS D1.1.

C. Copper Tube: ASTM B 88 (ASTM B 88M), Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.

2. Joints: Solder, lead free ASTM B32, HB alloy (95-5 tin antimony), or tin and silver.

3. Joints: Brazed, AWS A5.8, Classification BAg-36, non-cadmium silver alloy. Pipes 2-1/2-inches or larger or piping routed over food storage areas, computer rooms, telecommunications rooms, or electrical rooms.

2.02 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

3. Joints: Brazed, AWS A5.8, Classification BAg-36, non-cadmium silver alloy. Pipes 2-1/2-inch or larger or piping routed over computer rooms, telecommunications rooms, and electrical rooms.

2.03 UNIONS

A. Unions for Pipe 2-inches and Under:

1. Ferrous Piping: 150, 250, and 300 PSIG malleable iron, threaded, ASME B16.39.

2. Copper Pipe: Bronze, soldered joints, ASME B16.22.

B. Dielectric Connections: Provide dielectric waterway or brass nipple fitting with threaded ends. Dielectric unions are not allowed.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written instructions and requirements.

B. Preparation:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

2. Remove scale and dirt on inside and outside before assembly.

3. Prepare piping connections to equipment with flanges or unions.

4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

C. Above Grade Piping Installation:

1. Install per manufacturer's written instructions and requirements.

2. Install heating water, glycol, condenser water, piping to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.

3. Route piping in orderly manner, parallel to building structure, and maintain gradient.

4. Install piping to conserve building space and to avoid interference with use of space.

5. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

6. Sleeve pipe passing through partitions, walls and floors allowing adequate space for pipe insulation.

7. Slope piping at 0.2 percent upward in direction of flow and arrange to drain at low points.

8. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

9. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

10. Drawings are diagrammatic and do not necessarily show top connections in all cases. Install branch connections to mains using tee fittings in main, with takeoff coming out of the top unless trade coordination conditions preclude it.

11. Anchor piping for proper direction of expansion and contraction.

12. Inserts:

    a. Provide inserts for placement in concrete formwork.

    b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

    c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.

    d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

    e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

13. Pipe Hangers and Supports:

    a. Install in accordance with Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.

    b. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

    c. Place hangers within 12-inches of each horizontal elbow.

    d. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

    e. Support vertical piping at top, bottom, and not less than every other floor. Support riser piping independently of connected horizontal piping.

    f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

    g. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

    h. Provide copper plated hangers and supports for copper piping.

    i. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

14. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

15. Provide access where valves and fittings are not exposed.

16. Use eccentric reducers to maintain top of pipe level.

17. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

18. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

D. Field Quality Control:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.

4. Isolate equipment from piping. If a valve is used to isolate equipment, provide closure capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

6. Perform the following tests on hydronic piping:

a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

b. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.

c. Check expansion tanks to determine that they are not air bound and that system is full of water.

d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure not-to-exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."

e. After hydrostatic test pressure has been applied for at least four hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

f. Prepare written report of testing.

E. Flushing and Cleaning of Piping Systems:

1. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning,

purging, and circulating fluids through the piping system.

2. Use temporary strainers and temporary pumps that can create a minimum fluid velocity of 6-feet per second and maximum of 10-feet per second to flush and clean the piping systems. Do not use Owner's permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.

3. When constructing minor piping modifications or additions, verify with Owner if the Owner's pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, ensure the strainer baskets and screens installed in the piping systems permanent strainers are replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then replace straining element with a new strainer and clean and deliver the old straining elements to Owner. Fit the Owner's strainers with a line size blowoff valve.

4. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.

5. Circulate a chemical cleaner in chilled, heating, and condenser water piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The chilled, heating, and condenser water system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Owner so that the reinstallation of clean strainer screens may be witnessed.

F. Pipe Painting Requirements:

1. Paint all ferrous metal pipe including flanges. Do not paint flange bolts, washers and nuts. At flexible coupling the only the flanges are to be painted. All rubber portions are to remain unpainted.

2. Paint exterior uninsulated steel piping with exterior latex, semi-gloss (AE), Master Painters Institute MPI 11, suitable for metallic surfaces B, Haze Gray color.

3. Use ready-mixed (including colors) paint. Prime paint with pigment and vehicle, compatible with substrate and finish coats specified. Volatile Organic Compounds (VOC) content of paint materials shall not exceed 50g/l for exterior latex paints and primers. Lead-based paint is not permitted.

4. Do not apply coating when air or substrate conditions are:

   a. Less than 5 degrees F above dew point.

   b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the product manufacturer.

5. Do no exterior painting when it is windy and dusty. Do not paint in direct sunlight or on surfaces that the sun will soon warm.

6. Apply only on clean, dry and frost-free surface. Remove all materials the will affect the ability of the paint to adhere to the pipe including painted pipe identification labels.

7. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign. Remove loose mill scale, rust, and paint, by hand or power tool cleaning. All surfaces are to be dry at the time paint is applied.

8. Apply paint in two coats; prime, and finish. Apply each coat evenly and cover substrate completely. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions.

9. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects. Apply by brush, roller or spray.

END OF SECTION

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Air Vents
2. Pressure Reducing Valves
3. Liquid Flow Switches
4. Differential Pressure Switches
5. Instrument Probe Fittings
6. Strainers
7. Suction Diffusers
8. Relief Valves

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
2. Certificates: Inspection certificates for pressure vessels from Authority Having Jurisdiction (AHJ).
3. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
4. Project Record Documents: Record actual locations of flow controls.
    a. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum three years of documented experience.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Air Vents:

1. Armstrong International, Inc.
2. ITT Bell & Gossett
3. Taco, Inc.
4. Hoffman
5. Amtrol
6. Metraflex

B. Pressure Reducing Valves:

1. Armstrong
2. ITT Bell & Gossett
3. Taco, Inc.
4. Amtrol

5. Kunkle

C. Liquid Flow Switches:

1. McDonnell & Miller
2. Dwyer
3. Or approved equivalent.

D. Differential Pressure Switches:

1. Dwyer Instruments
2. Or approved equivalent.

E. Instrument Probe Fittings:

1. Pete's Plug
2. Or approved equivalent.

F. Strainers:

1. Armstrong International
2. Mueller
3. Keckley
4. Hoffman

G. Suction Diffusers:

1. ITT Bell & Gossett
2. Armstrong
3. Taco, Inc.
4. Amtrol
5. Wheatly
6. Mueller
7. Or approved equivalent.

H. Relief Valves:

1. Armstrong
2. ITT Bell & Gossett
3. Taco, Inc.

4. Amtrol

2.02 AIR VENTS

A. Manual Type: Short vertical sections of pipe to form air chamber, with 1/8-inch brass needle valve at top of chamber.

B. Automatic Float Type: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, drain connection, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.03 PRESSURE REDUCING VALVES

A. Brass body, adjustable range, inlet check valves, removable inlet strainer, noncorrosive valve seat and stem, 3/4-inch size unless otherwise shown, factory set at fill pressure as indicated on drawings.

2.04 LIQUID FLOW SWITCHES

A. Description: Brass for wetted parts with packless construction, paddle with removable segments for pipe size and flow velocity, vapor proof electrical compartment for switches mounted on cold hydronic piping systems, switches for 115V, 60 Hz, 1-phase with 7.4A rating.

2.05 DIFFERENTIAL PRESSURE SWITCHES

A. Sensing Range: 0- to 1.0-inch water column. Diaphragm operated with switching accomplished by photocell controlled relays, adjustable switch setpoints that close contacts on the relay if the differential pressure sensed raised above the setpoint, incorporate a pointer type gauge with divisions of 0.02-inch WC.

2.06 INSTRUMENT PROBE FITTINGS

A. Brass or stainless steel body and cap, high pressure rated, valve material neoprene, Nordal or Viton to suit temperature range, 1/4-inch or 1/2-inch NPT tailpiece.

2.07 STRAINERS

A. Size 2-inches and Under: Screwed brass or iron body for 175 PSI working pressure, Y pattern with 1/16-inch stainless steel perforated screen.

B. Size 2-1/2-inches and Larger: Flanged or grooved and above: iron body for 175 PSI working pressure, Y pattern with 1/16 stainless steel perforated screen.

C. Basket Pattern: Flanged iron body for 175 PSI working pressure, basket pattern with 1/8-inch stainless steel perforated screen, clamped or bolted cover.

2.08 SUCTION DIFFUSERS

A. Fitting: Angle pattern, cast-iron body, threaded for 2-inch and smaller, flanged for 2-1/2-inch and larger, rated for 175 PSI working pressure, with inlet vanes, cylinder strainer with 30 mesh stainless steel screen to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning, adjustable support foot.

2.09 RELIEF VALVES

A. Size and capacity as selected by installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 125 PSI.

C. Pressure Relief Valves: Bronze body, test lever, ASME rated. Provide pressure relief as indicated on drawings.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install specialties in accordance with manufacturer's instructions.

B. Support pump fittings with floor mounted pipe and flange supports. Provide vibration isolation, same as pump, to avoid short circuiting.

3.02 AIR VENTS

A. Where large air quantities can accumulate, provide enlarged air collection standpipes.

B. Automatic: Furnish and install automatic air vents in mechanical equipment rooms and outdoors only. Install at high points of system piping, at heat transfer coils, and elsewhere as required for system air venting. Vents: 3/4-inch with 1/2-inch IPS drain piping to the nearest floor drain or other approved location. Provide a ball valve and union ahead of all automatic air vents. Do not install above ceilings or locations where discharge may occur and cause damage.

C. Manual Vents: Provide at high points of system piping, at heat transfer coils, and elsewhere as required for system venting where automatic air vents are not to be installed. Provide 10-inch length of 1/4-inch copper tube with 180 degree bend down to discharge into hand-held bucket.

3.03 PRESSURE REDUCING VALVES

A. Install as indicated, and in accordance with manufacturer's instructions with three valve bypass.

3.04 LIQUID FLOW SWITCHES

A. Install on inlet to water chiller and on other equipment as indicated. Install in horizontal pipe with switch mounted in tee on top of pipe with minimum of 24 inches of straight pipe with no fitting both upstream and downstream of switch. Remove segments of paddle to fit in accordance with manufacturer's instructions.

3.05 DIFFERENTIAL PRESSURE SWITCHES

A. Install per manufacturer's recommendations where shown on Drawings.

3.06 INSTRUMENT PROBE FITTINGS

A. Test Plugs: Install where indicated and in accordance with the manufacturer's recommendations.

3.07 STRAINERS

A. Provide valved drain and hose connection on strainer blow down connection.

3.08 SUCTION DIFFUSERS

A. Provide pump suction diffuser on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

3.09 RELIEF VALVES

A. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

B. Pipe relief valve outlet to nearest floor drain.

C. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

D. Water Relief Valves: Install as indicated, and on expansion tanks, hot water tanks and pressure vessels. Pipe discharge to floor drain. Comply with ASME Boiler and Pressure Vessel Code.

END OF SECTION

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. General Pump Requirements
2. Installation of Owner Provided Pumps

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association, current edition.
2. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association, current edition.
3. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.
4. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc., current edition.

1.04 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirement.

1.05 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.07 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Mechanical Seals: One mechanical seal for each pump.

PART 2 - PRODUCTS

2.01 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.

C. Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Provide premium efficiency motors according to IEEE 112, Test Method.

PART 3 - EXECUTION

3.01 GENERAL PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions according to ANSI/HI 1.1-1.5 "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation.

B. Provide access space around pumps for service including removing motors, impellers, couplings, and accessories. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Eccentric reducers where necessary to prevent air entrapment. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4-inches and over. Provide vibration isolation to ensure there is no short circuiting of pump vibration isolator.

D. Unless indicated otherwise on drawings, provide line sized shut-off valve and strainer or pump suction fitting on pump suction, and line sized soft seat check valve and balancing valve and shut off valve on pump discharge.

E. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

F. Lubricate pumps before start-up.

G. Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

H. Install piping adjacent to pumps to allow service and maintenance.

I. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

J. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

K. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

L. Install pressure gauges on pump suction and discharge. Install at integral pressure-gauge tappings where provided.

M. Install temperature and pressure-gauge connector plugs in suction and discharge piping around each pump.

N. Install electrical connections for power, controls, and devices.

O. Electrical power and control wiring and connections are specified in Division 26, Electrical Sections.

P. Ground equipment.

Q. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

R. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.

2. Review data in maintenance manuals. Reference Division 01, General Requirements.

3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

S. Examine equipment foundations and anchor -bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

T. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Chemical Feed Description
2. Chemical Feeding Equipment
3. Chemical Treatment Test Equipment
4. Chemicals
5. Supplemental Services/Components

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Qualifications: Firms regularly engaged in manufacture of components of types and sizes required.
2. Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction. Consult equipment manufacturer prior to acceptance of values noted below.

1. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics:

a. pH: Maintain a value within 9.0 to 10.5.

b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.

c. Boron: Maintain a value within 100 to 200 ppm.

d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.

e. Soluble Copper: Maintain a maximum value of 0.20 ppm.

f. TDS: Maintain a maximum value of 10ppm.

g. Ammonia: Maintain a maximum value of 20 ppm.

h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.

i. Microbiological Limits:

1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.

2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.

3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.

4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.

5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

2. Condenser Water, Medium-to-Large Cooling Tower System (over 50 tons): Maintain system essentially free of scale and total suspended solids to sustain the following water characteristics:

a. pH: Maintain a value within 8.0 to 9.1.

b. "P" Alkalinity: Maintain a maximum value of 100 ppm.

c. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.

d. Soluble Copper: Maintain a maximum value of 0.20 ppm.

e. TDS: Maintain a maximum value of 10 ppm.

f. Ammonia: Maintain a maximum value of 20 ppm.

g. Free "OH" Alkalinity: Maintain a maximum value of 0 ppm.

h. Microbiological Limits:

1) Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.

2) Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.

3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.

4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.

5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

i. Polymer Testable: Maintain a minimum value within 10 to 40.

3. Passivation for Galvanized Steel (for the first 60 days of operation):

a. pH: Maintain a value within 7 to 8.

b. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.

c. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

1.08 MAINTENANCE

A. Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the cooling, chilled-water piping and heating hot-water piping and equipment. Services and chemicals provided for a period of one year from date of Substantial Completion, including the following:

1. Initial water analysis and recommendations.

2. Startup assistance.

3. Periodic field service and consultation.

4. Customer report charts and log sheets.

5. Laboratory technical assistance.

6. Analyses and reports of chemical items concerning safety and compliance with government regulations.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Chemicals: Furnish quantity equal to 50 percent of amount initially installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Aqua-Chem, Inc.; Cleaver-Brooks Div.

B. Betz Dearborn, Inc.

C. Calgon Corp., ECC International

D. ITOH2 Industrial Treatment of Water

E. Nalco Chemical Co.

F. US Water Services

G. Chemcoa

H. Cleaver-Brooks

I. Sarco

J. Or approved equivalent.

2.02 CHEMICAL FEED DESCRIPTION

A. Closed-Loop System: One bypass feeder on each system with isolating and drain valves downstream from circulating pumps, unless otherwise indicated.

1. Introduce chemical treatment through bypass feeder when required or indicated by test.

B. Open-Loop, Condenser Water Piping: Pump sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Use agitator as required.

1. Intermittently feed biocide to condenser water to achieve a toxic level of the chemical to kill the organism present.

2. Change biocides periodically to avoid chemical immunity.

3. Activate chemical solution pump from water meter in makeup water line to cooling tower when condenser water pumps are running.

4. Automatically feed chemical with electronic solid-state controllers.

5. Deactivate solution pump and signal alarm by a liquid-level switch in each solution tank on low chemicals.

C. Existing Systems:

1. Prior to filling new hydronic distribution systems, verify existing chemical treatment system is adequate for installed system pipe longevity.

2.03 CHEMICAL FEEDING EQUIPMENT

A. Bypass Feeders: Cast iron or steel, for introducing chemicals into system; with funnel shutoff valve on top, air-release valve on top, drain valve on bottom, and recirculating shutoff valves on sides.

1. Capacity: 1.8 gallon for systems with less than 1,000 gallon volume and 5 gallon for systems with more than 1,000 gallon volume.

2. Working Pressure: 125 PSIG or 175 PSIG.

B. Drip Feeders: Plastic reservoir with capillary tubing probe, weight, charging syringe, and clip.

C. Positive-Displacement Diaphragm Pump: Simplex, self-priming, rated for intended chemical with 25 percent safety factor for design pressure and temperature.

1. Adjustable flow rate.

2. Thermoplastic construction.

3. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor.

4. Built-in relief valve.

5. Retain pump type in paragraph above or below. Use diaphragm pump for normal operating pressures. Use piston pump for higher operating pressures.

D. Positive-Displacement Piston Pump: Metal and thermoplastic construction.

1. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor.

2. Built-in relief valve.

E. Chemical Solution Tanks: Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings.

1. Molded fiberglass cover with recess for mounting pump, agitator, and liquid-level switch.

2. Capacity: 30 gallon.

3. Secondary containment spill pallets for chemical solution tanks:

a. Material: Polyethylene.

b. Capacity: 66 gallons each.

c. Provide each pallet with grating and drain plug.

d. Provide one portable loading ramp.

e. Quantity: Two.

F. Agitator: Direct drive, 1750 rpm, mounted on tank with angle adjustment.

1. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor.

2. Stainless-steel clamp and motor mount, with stainless-steel shaft and propeller.

G. Liquid-Level Switch: Polypropylene housing, integrally mounted PVC air trap, receptacles for connection to metering pump, and low-level alarm.

H. Packaged Conductivity Controller: Solid-state circuitry, 5 percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control-function light, output to control circuit, and recorder.

I. Cold-Water Meter: Positive-displacement type with sealed, tamperproof magnetic drive; impulse contact register; single-pole, double-throw, dry-contact switch.

1. Rotating-disc or Turbine type with bronze or cast-iron body rated for 125 PSIG (860 kPa).

2. Magnetic-drive or mechanical-impulse contactor matched to signal receiver.

3. At least six-digit totalizers.

4. 120-V ac.

J. Solenoid Valves: Forged-brass body, globe pattern, and general-purpose solenoid enclosure with 120-V, continuous-duty coil.

K. Electronic Timers: 150-second and 5-minute ranges, with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.

L. Chemical Tubing: Schedule 40, PVC with solvent-cement joints; or polypropylene tubing with heat fusion.

M. Plastic Ball Valves: Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals.

N. Plastic-Body Strainer: Rigid PVC or CPVC with cleanable stainless-steel strainer element.

O. Condenser Water-Treatment Control Panel: Incorporate solid-state integrated circuits and digital LED displays, in NEMA 250, Type 12 enclosure with gasketed and lockable door. Provide alarm outputs to building automation system.

1. Control dissolved solids, based on conductivity, and include the following:

a. Digital readout display.

b. Temperature-compensated sensor probe adaptable to sample stream manifold.

c. High, low, and normal conductance indicator lights.

d. High or low conductance alarm light, trip points field adjustable; with silence switch.

e. Hand-off-auto switch for solenoid bleed-off valve.

f. Bleed-off light to indicate valve operation.

g. Internal adjustable hysteresis or dead band.

2. Control inhibitor feeding, based on makeup volume, and include the following:

a. Solid-state reset counter (accumulator), with selections from 1 to 15.

b. Solid-state timer, adjustable from 15 to 300 seconds.

c. Test switch.

d. Hand-off-auto switch for chemical pump.

e. Illuminated legend to indicate feed when pump is activated.

f. Solid-state lockout timer, adjustable from 15 to 180 minutes, with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.

g. Electromechanical-type, panel-mounted makeup totalizer to measure amount of makeup water.

3. Control biocide with an adjustable time programmer and include the following:

a. 24-hour timer with 14-day skip feature to permit activation any hour of day.

b. Precision, solid-state, bleed-off lockout timer (zero to nine hours) and clock-controlled biocide pump timer (zero to two and one-half hours). Prebleed and bleed lockout.

c. Solid-state alternator to enable the use of two different formulations.

d. 24-hour digital display of time of day.

e. 14-day LED display of day of week.

f. Fast and slow internal clock set controls.

g. Battery backup so clock is not disturbed by power outages.

h. Quartz timekeeping accuracy.

i. Hand-off-auto switches for biocide pumps.

j. Biocide A and Biocide B illuminated legends to indicate pump is running.

2.04 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer recommended equipment and chemicals, in a carrying case, for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, and total alkalinity and for calcium hardness field tests.

B. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

1. Three station rack for closed-loop system.

2. Four station rack for open condenser water systems.

2.05 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

C. Biocide: Chlorine release agents or microbiocides.

D. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

E. Open-Loop, Condenser Water Piping Chemicals: Sequestering agent to inhibit scaling, acid to reduce alkalinity and pH, corrosion inhibitor, and biocide.

2.06 SUPPLEMENTAL COMPONENTS/SERVICES

A. Drain and makeup water piping to comply with the requirements of Division 22, Plumbing. Drains which connect to sanitary sewer systems to be connected by means of an indirect waste.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Water Analysis:

1. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

2. Existing Systems:

a. Prior to filling new hydronic distribution systems, verify existing chemical treatment system is adequate for installed system pipe longevity.

B. Installation:

1. Install treatment equipment level and plumb. Provide power to all system devices.

2. Add cleaning chemicals as recommended by manufacturer.

3. To prevent dirt and solids from lodging the coils, before adding cleaning chemical to the closed system, air handling coils and fan coil units to be isolated by closing the inlet and outlet valves and opening the bypass valves Do not valve in or operate system pumps until after system has been cleaned.

4. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the by-pass valves. Also, clean strainers.

C. Connections:

1. Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Provide a by-pass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.

3. Bleed off water piping with bleed off piping assembly to be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping to be upstream of chemical injection nozzles.

4. Provide piping for the flow assembly piping to the main control panel and accessories.

    a. The inlet piping to connect to the discharge side of the circulating water pump.

    b. Piping to connect to the water piping service the cooling tower downstream of the heat source.

    c. Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.

    d. Install injection nozzles with corporation stops in the water piping service the cooling tower downstream of the heat source.

    e. Provide piping for corrosion monitor rack per manufacturers installation instructions. Provide ball valves to isolate and service rack.

    f. Provide piping for erosion chemical feeder per manufacturer's installation instructions. Provide ball valves to isolate and service feeder.

5. Install piping adjacent to equipment to allow service and maintenance.

6. Confirm applicable electrical requirements in Division 26, Electrical Sections for connecting electrical equipment.

7. Ground equipment.

    a. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Field Quality Control:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

    a. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.

    b. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

2. Test chemical feed piping as follows:

    a. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.

b. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

c. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

d. Cap and subject piping to static water pressure of 50 PSIG (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.

e. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.

f. Prepare test reports, including required corrective action.

E. Adjusting:

1. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare certified test report for each required water performance characteristic. Where applicable, comply with ASTM D 3370 and the following standards:

a. Silica: ASTM D 859.

b. Steam System: ASTM D 1066.

c. Acidity and Alkalinity: ASTM D 1067.

d. Iron: ASTM D 1068.

e. Water Hardness: ASTM D 1126.

2. Occupancy Adjustments: Within 12 months of Substantial Completion, perform two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis.

F. Gauge Adjusting and Cleaning:

1. Adjust faces of meters and gauges to proper angle for best visibility.

2. Clean windows of meters and gauges and factory finished surfaces. Replace cracked or broken windows, repair scratched or marred surfaces with manufacturer's touch-up paint.

G. Demonstration:

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

a. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

2. Review manufacturer's safety data sheets for handling of chemicals.

3. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.

4. Schedule at least four hours of training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 23 52 00 - HEATING BOILERS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Installation of Owner Provided Boilers

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install boiler in accordance with manufacturer’s instructions.

B. Provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes, and fuel oil tanks. Pipe gas vents to atmosphere.

C. Boilers Installed in Battery: Do not install boilers closer than 48-inches from each other, except boilers that operate at up to 2,000,000 BTU/hr, installed according to manufacturer's instructions.

D. Provide connection to fuel oil tanks and pumps as indicated.

E. Install boiler on concrete housekeeping base, sized minimum 4-inches larger than boiler base.

F. Provide piping connections and accessories as indicated. Reference Division 23, HVAC, Hydronic Specialties.

G. Pipe relief valves to nearest floor drains.

H. Pipe relief valves to outdoors.

I. Provide for connection to electrical service.

J. Provide all wiring between control panels and devices and unit.

K. Mount thermometer in boiler breeching within 12 inches of flue nozzle.

L. Pipe boiler drains to nearest floor drains.

M. System Start-Up:

1. Provide the services of manufacturer's field representative for starting and testing unit.

2. After installation and pipe flushing, boil out boilers using chemical and procedure as recommended and supervised by boiler manufacturer.

3. Manufacturer shall provide report verifying that boilers have been inspected, cleaned and tested according to their recommendations.

N. Closeout Activities:

1. Train operating personnel in operation and maintenance of units.

2. Provide the services of manufacturer's field representative to conduct training.

O. Boiler Shutdown:

1. Remote switch: Install shutdown switch to disconnect power to the boiler burner controls and gas service in room. Install pushbutton under clear, impact-resistant flip lid. Provide red phenol label "Emergency Shutdown" locate label above pushbutton. Mount pushbutton by latch side of each boiler/mechanical room door within interior of the room, unless otherwise directed by AHJ. Provide electrical wiring and raceway as necessary for installation. Provide additional relays and wiring to cut power to gas solenoid valves in the room not integral to boilers. Reference drawings for gas solenoid valve locations.

2. For gas fired boilers and/or water heaters located in a Refrigeration Machinery Room, shut down all gas fired equipment on refrigerant leakage.

END OF SECTION

SECTION 23 64 00 - PACKAGED WATER CHILLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Installation of Owner Provided Chiller

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 COORDINATION

A. Coordinate size and location of concrete bases including but not limited to sufficient base footprint to allow proper anchorage and anchor-bolt inserts.

B. Coordinate installation of roof curbs and penetrations.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's instructions. Maintain manufacturer's recommended clearances for service and maintenance.

B. Provide connection to electrical service, low voltage wiring and power.

C. Provide connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit. Provide wiring between flow switches and control panel. Provide all internal power and low voltage control wiring within unit. Coordinate with Division 26, Electrical.

D. Install chiller and components on concrete pad capable of supporting the chiller, components and weight of water. See Division 03, Concrete for concrete pad requirements.

E. Install units on vibration isolation.

F. Provide seismic restraints in accordance with Division 23, HVAC Sections.

G. Provide evaporator connections to chilled water piping. Provide additional accessories as shown on details, schedule, and piping diagrams. (Additional requirements may be shown on Drawings).

H. Provide necessary auxiliary water piping for oil cooling units.

I. Insulate evaporator and cold surfaces. Reference Section 23 07 00, HVAC Insulation.

J. Provide condenser connections to condenser water piping. Provide additional accessories as shown on details, schedule, and piping diagrams.

K. Arrange piping for easy dismantling to permit tube cleaning and to permit for removal of chiller.

L. Provide piping from chiller rupture disc to outdoors. Size as recommended by manufacturer.

M. Install separate devices furnished by manufacturer.

N. Starting Equipment and Systems:

1. Engage factory-authorized service representative to perform startup service.

2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

3. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

a. Verify that refrigerant charge is sufficient and water chiller has been leak tested.

b. Verify that pumps are installed and functional.

c. Verify that thermometers and gauges are installed.

d. Operate water chiller for run-in period according to manufacturer's written instructions.

e. Check bearing lubrication and oil levels.

f. Verify that refrigerant pressure relief is vented outside.

g. Verify proper motor rotation.

h. Verify static deflection of vibration isolators, including deflection during water chiller and startup and shutdown.

i. Verify and record performance of chilled- and condenser-water flow and low-temperature interlocks.

j. Verify and record performance of water chiller protection devices.

k. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

4. Prepare written startup report that records results of tests and inspections.

5. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

6. Supply initial charge of refrigerant and oil.

7. Demonstrate system operation and verify specified performance.

END OF SECTION

SECTION 23 65 00 - COOLING TOWERS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Installation of Owner Provided Cooling Tower

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.

2. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.

3. AHRI 575 - Method of Measuring Machinery Sound Within an Equipment Space

4. ASME PTC 23 - Atmospheric Water-Cooling Equipment; The American Society of Mechanical Engineers

5. CTI ATC-105 - Acceptance Test Code; Cooling Technology Institute

6. CTI STD ATC-105S Acceptance Test Code for Closed Circuit Coolers

7. CTI ATC-128 - Measurement and Evaluation of Sound from Water Cooling Tower; Cooling Technology Institute

8. CTI STD 151 - VFD Application for Cooling Towers

9. CTI STD-201 - Certification Standard for Commercial Water Cooling Towers; Cooling Technology Institute

10. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association

11. NFPA 70

1.04 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 WARRANTY

A. Warranty of materials and workmanship as required in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's instructions.

B. Install tower on structural steel beams as instructed by manufacturer.

C. Connect condenser water piping with flanged or grooved connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower.

D. Connect make-up water piping with flanged or union connections to tower. Pitch to tower.

E. Connect overflow, bleed, and drain.

F. Connect to water treatment system.

G. Inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

H. Supervise rigging, hoisting, and installation.

I. Start-up tower in presence of and instruct Owner's operating personnel.

J. Test for capacity under actual operating conditions in accordance with CTI ATC-105, and verify specified performance.

END OF SECTION

MECHANICAL SYMBOL LIST

DUCTWORK

- SUPPLY AIR
- RETURN OR EXHAUST AIR
- OUTSIDE AIR
- ROOM THERMOSTAT (AC-1)
- EQUIPMENT IDENTIFICATION (AC-1)
- DIFFUSER OR GRILLE IDENTIFICATION (12x12 / 100 CD-1)

DAMPERS

- VOLUME DAMPER
- FIRE DAMPER (FD)
- FIRE/SMOKE DAMPER (FSD)
- SMOKE DAMPER (SD)
- MOTORIZED DAMPER (MD)

DUCTWORK FITTINGS

- MITERED ELBOW WITH TURNING VANES
- RADIUSED ELBOW
- RECTANGULAR MAIN WITH ROUND BRANCH
- RECTANGULAR MAIN WITH RECTANGULAR BRANCH
- CONCENTRIC SQUARE TO ROUND
- ECCENTRIC TRANSITION, RECTANGULAR OR ROUND
- NON-SYMMETRICAL WYE
- SYMMETRICAL WYE
- RECTANGULAR DUCT RISER
- ROUND DUCT RISER
- RECTANGULAR DUCT DROP
- ROUND DUCT DROP
- RECTANGULAR OFFSET LESS THAN 15°
- RECTANGULAR OFFSET MORE THAN 15°
- ROUND WYE
- EXTRACTOR (EX)
- BELLMOUTH
- ROUND DUCT WITH ROUND BRANCH
- CONCENTRIC TRANSITION, RECTANGULAR OR ROUND
- ACCOUSTICALLY LINED DUCT (SIZES SHOWN ARE NET INSIDE)
- FLEXIBLE CONNECTION

EQUIPMENT

- COOLING TOWER
- CHILLER, WATER COOLED
- CHILLER, AIR COOLED

PIPING VALVES

- VALVE, GENERAL
- PRESSURE REDUCING VALVE
- CHECK VALVE
- QUARTER TURN VALVE
- GLOBE VALVE
- BALANCING VALVE
- MOTORIZED, 2-WAY VALVE
- MOTORIZED, 3-WAY VALVE

PIPING FITTINGS

- PIPE RISE
- PIPE DROP
- TEE UP ON PIPE
- TEE DOWN ON PIPE
- CONTINUATION
- CAP
- HOSE BIBB
- PRESSURE GAUGE WITH COCK
- THERMOMETER
- PIPE TO DRAIN
- VENT TO ATMOSPHERE
- AIR SEPARATOR (S)
- TEMPERATURE SENSOR
- AUTOMATIC FLOW CONTROL (AFC)
- BACKFLOW PREVENTER (BFP)
- PRESSURE RELIEF VALVE
- T&P RELIEF VALVE WITH PIPE TO DRAIN
- EXPANSION TANK (ET)
- EXPANSION JOINT (EJ)
- PRESSURE SENSOR
- FLOW
- DIFFERENTIAL PRESSURE SENSOR
- SHOCK ABSORBER (S)
- HEAT EXCHANGER (HE)
- WATER METER (M)
- EXPANSION LOOP
- MANUAL AIR VENT
- AUTOMATIC AIR VENT
- TEST PORT (PETE'S PLUG OR EQUAL)
- FLOW METER
- BTU METER
- UNION
- PUMP (P)
- FLOOR DRAIN (FD)

PIPING SYSTEMS

- CWS — CONDENSER WATER PIPING SUPPLY
- CWR — CONDENSER WATER PIPING RETURN
- CHWS — CHILLED WATER PIPING SUPPLY
- CHWS — CHILLED WATER PIPING RETURN
- HWS — HEATING WATER SUPPLY
- HWR — HEATING WATER RETURN
- MPG — MEDIUM PRESSURE GAS
- HPG — HIGH PRESSURE GAS
- SNG — SYNTHETIC NATURAL GAS
- SNG — BELOW GRADE SYNTHETIC NATURAL GAS
- ICW — INDUCTRIAL COLD WATER
- SANITARY BELOW GRADE
- COLD WATER

ABBREVIATIONS

A/C	AIR CONDITION(ED)
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
BDD	BACKDRAFT DAMPER
BFP	BACKFLOW PREVENTER
BFF	BELOW FINISHED FLOOR
BHP	BRAKE HORSEPOWER
BWV	BACKWATER VALVE
CD	CEILING DIFFUSER
CD	CONDENSATE DRAIN
CV	CHECK VALVE
COP	COEFFICIENT OF PERFORMANCE
CONT.	CONTINUATION
COTG.	CLEANOUT TO GRADE
CU	CONDENSING UNIT
CW	COLD WATER
D	DROP
DB	DECIBEL
DB	DRY BULB
DIA	DIAMETER
DX	DIRECT EXPANSION
EAT	ENTERING AIR TEMPERATURE
EER	ENERGY EFFICIENCY RATING
EF	EXHAUST FAN
EEF	EFFICIENT
ELECT	ELECTRICAL
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
F	FAHRENHEIT
FD	FIRE DAMPER
FLA	FULL LOAD AMPS
FT	FEET
GAL	GALLONS
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HD	HEAD
HP	HORSEPOWER
HTG	HEATING
HTR	HEATER
HWC	HOT WATER COIL
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN	INCHES
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LBS.	POUNDS
LH	LATENT HEAT
MA	MIXED AIR
MAX	MAXIMUM
MBH	THOUSAND BTU'S PER HOUR
MIN	MINIMUM
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
NO.	NUMBER
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER
OD	OUTSIDE DIAMETER
PD	PRESSURE DROP
PH	PHASE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PW	PUMPED WASTE
QTY	QUANTITY
R	RISE
RA	RETURN AIR
RET	RETURN
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SEER	SEASONAL ENERGY EFFICIENCY RATING
SF	SQUARE FEET
SH	SENSIBLE HEAT
SOV	SHUT OFF VALVE
SP	STATIC PRESSURE
TD	TEMPERATURE DIFFERENCE
TEMP	TEMPERATURE
TH	TOTAL HEAT
TP	TOTAL PRESSURE
V	VOLT
VTR	VENT TO ROOF
W	WATT
W/	WITH
WB	WET BULB
WC	WATER COLUMN
WCO	WALL CLEANOUT
W/O	WITHOUT

GENERAL MECHANICAL NOTES

A. CONDITIONS SHOWN ON THE PLANS RELATIVE TO THE WORK TO BE PERFORMED ARE BASED ON THE BEST INFORMATION AVAILABLE BUT ARE SUBJECT TO FIELD VERIFICATION. VERIFY LOCATIONS AND ELEVATIONS OF DUCTWORK AND UTILITIES PRIOR TO INSTALLATION.

B. INSTALL EQUIPMENT WITH SUFFICIENT ACCESS TO PANELS, ELECTRICAL CONNECTIONS, CONTROLS, FILTERS, MOTORS, ETC. COORDINATE ACCESS TO ALL DAMPERS, VALVES, AND OTHER SERVICEABLE EQUIPMENT. REVIEW CEILING HEIGHTS AND COORDINATE ACCESS PANEL LOCATIONS.

C. "DEMOLISH" OR "REMOVE" MEAN: REMOVE AND RETURN TO OWNER FOR ACCEPTANCE, AND DISPOSE OF ANY ITEMS NOT ACCEPTED BY THE OWNER.

D. COORDINATE WITH DIVISION 26 FOR LOCATION OF POWER AND LOCAL DISCONNECTS FOR MECHANICAL EQUIPMENT DEVICES. PROVIDE STARTERS FOR EQUIPMENT WITHOUT VFD 'S, ECM MOTORS, OR EQUIPMENT WITHOUT INTEGRAL STARTERS.

E. MAINTAIN MINIMUM ELECTRICAL CODE AND UNIT MANUFACTURER'S CLEARANCES TO ADJACENT CONSTRUCTION OR EQUIPMENT PER NEC.

SHEET INDEX

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CLACKAMAS COUNTY
Red Soils Campus, Oregon City

CLACKAMAS COUNTY

REVISIONS

COVER/LEGEND - MECHANICAL

ISSUE DATE: 05-23-2023
PROJECT NO.: 052011

SHEET **M0.1**

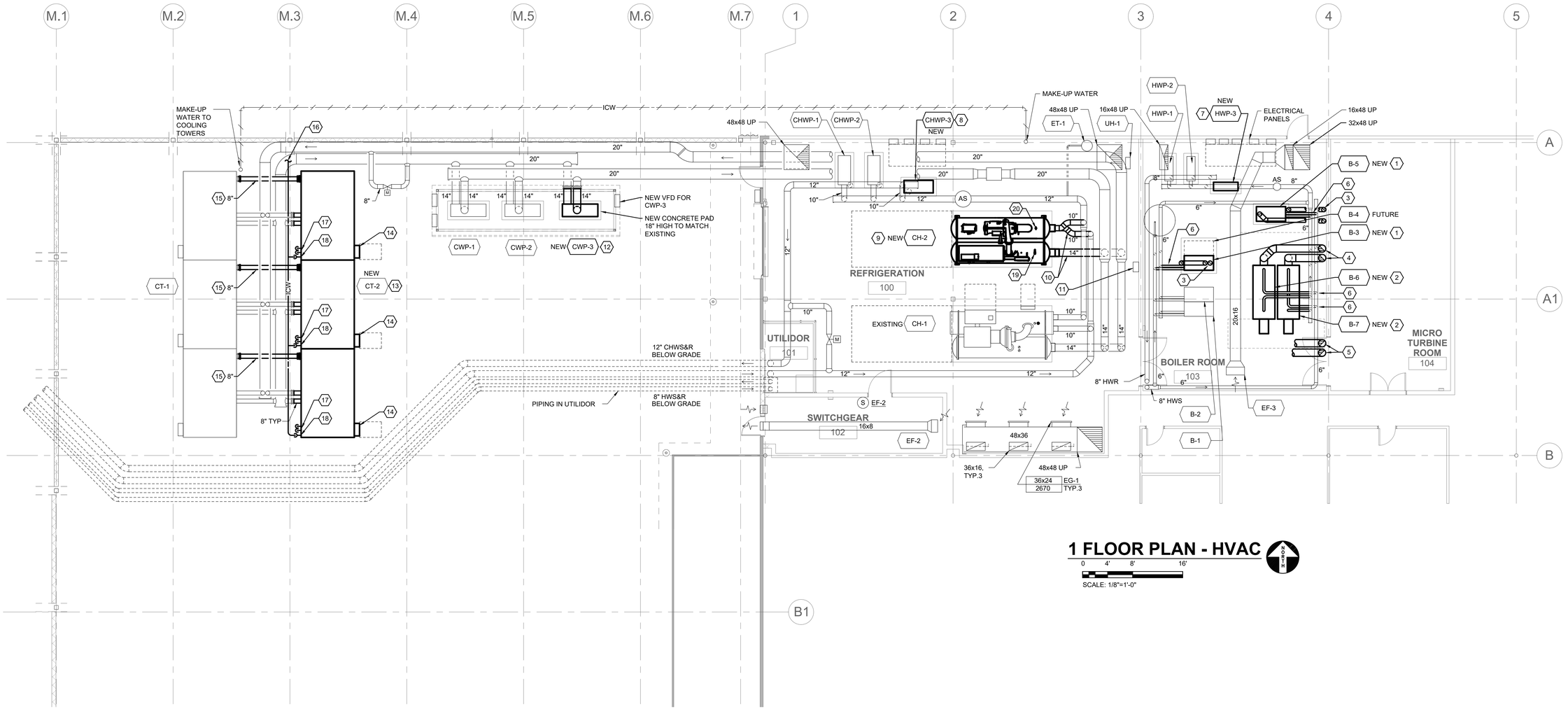
BID SET

GENERAL SHEET NOTES

A. ALL WALLS AND PARTITIONS IN REFRIGERATION, BOILER AND MICRO-TURBINE ROOM ARE FIRE RATED. ALL NEW PENETRATIONS TO MAINTAIN EXISTING RATINGS.

SHEET KEYNOTES

1. NEW NATURAL GAS BOILER- MOUNT ON NEW HOUSEKEEPING PAD TO MATCH EXISTING BOILERS. MAINTAIN REQUIRED CLEARANCES.
2. NEW DUAL FUEL BOILER- MOUNT ON NEW HOUSEKEEPING PAD AND MAINTAIN MANUFACTURERS REQUIRED CLEARANCES.
3. NEW 8"Ø FLUE AND 8" COMBUSTION AIR INTAKE UP. ROUTE THROUGH MEZZANINE AND THROUGH ROOF. OFFSET AIR INTAKE TO MAINTAIN REQUIRED CLEARANCES FROM EXHAUST OUTLET. COORDINATE ROUTING WITH OWNER. PROVIDE GOOSENECK TERMINATION ABOVE ROOF.
4. NEW 14"Ø FLUE UP. ROUTE THROUGH MEZZANINE AND THROUGH ROOF. COORDINATE ROUTING WITH OWNER. PROVIDE GOOSENECK TERMINATION ABOVE ROOF.
5. NEW 12"Ø COMBUSTION AIR INTAKE UP. ROUTE THROUGH MEZZANINE AND THROUGH ROOF. COORDINATE ROUTING WITH OWNER. PROVIDE GOOSENECK TERMINATION ABOVE ROOF.
6. NEW 4" HWS & HWR PIPING CONNECTION TO BOILER. CONNECT TO EXISTING VALVES. SEE PIPING DIAGRAM AND DETAILS FOR ACCESSORIES.
7. NEW PUMP TO BE INSTALLED ON NEW HOUSEKEEPING PAD TO MATCH EXISTING. NEW 6" PUMP INLET AND DISCHARGE PIPING TO BE CONNECTED TO EXISTING HEADER VALVES. OFFSET AS REQUIRED TO MAKE CONNECTIONS TO THE EXISTING HEADER. PROVIDE HYDRONIC SPECIALTIES AS INDICATED ON DETAILS AND PIPING SCHEMATICS.
8. NEW PUMP TO BE INSTALLED ON NEW HOUSEKEEPING PAD TO MATCH EXISTING. NEW 10" PUMP INLET AND DISCHARGE PIPING TO BE CONNECTED TO EXISTING HEADER VALVES. OFFSET AS REQUIRED TO MAKE CONNECTIONS TO THE EXISTING HEADER. PROVIDE HYDRONIC SPECIALTIES AS INDICATED ON DETAILS AND PIPING SCHEMATICS.
9. NEW CHILLER TO BE INSTALLED ON NEW HOUSEKEEPING PAD TO MATCH EXISTING.
10. NEW 10" CHWS & CHWR, NEW 14" CWS & CWR PIPING CONNECTIONS TO CHILLER. OFFSET AS REQUIRED TO MAKE CONNECTIONS TO THE EXISTING HEADER. PROVIDE HYDRONIC SPECIALTIES AS INDICATED ON DETAILS AND PIPING SCHEMATICS.
11. EXISTING REFRIGERANT MONITOR PANEL. INSTALL NEW SENSORS FOR NEW CHILLER AND CONNECT TO EXISTING PANEL. MATCH EXISTING CHILLER INSTALLATION.
12. NEW PUMP TO BE INSTALLED ON NEW HOUSEKEEPING PAD TO MATCH EXISTING. NEW 14" PUMP INLET AND DISCHARGE PIPING TO BE CONNECTED TO EXISTING HEADER VALVES. OFFSET AS REQUIRED TO MAKE CONNECTIONS TO THE EXISTING HEADER. PROVIDE HYDRONIC SPECIALTIES AS INDICATED ON DETAILS AND PIPING SCHEMATICS.
13. COOLING TOWER MOUNTED ON 60" TALL GALVANIZED STEEL STAND TO MATCH EXISTING. CONTRACTOR TO PROVIDE ENGINEERING AND INSTALLATION OF NEW STAND, CONCRETE PAD AND FOOTINGS.
14. FAN VFD MOUNTED ON COOLING TOWER STAND IN WEATHERPROOF VENTED ENCLOSURE.
15. NEW 8" EQUALIZATION LINE BETWEEN TOWERS. PROVIDE VALVE AT ONE END FOR ISOLATION.
16. CONNECT NEW 2-1/2" ICW TO EXISTING 3" LINE. INSULATE AND HEAT TRACE COOLING TOWER MAKE UP PIPING.
17. 3" DRAIN AND OVERFLOW CONNECTION. HEADER PIPING AND PIPE TO EXISTING CATCH BASIN.
18. 2" MAKE UP WATER CONNECTION. CONNECT TO NEW 2-1/2" ICW LINE. INSULATE AND HEAT TRACE ALL ICW PIPING.
19. 1-1/4" DUAL RELIEF VALVE ON CONDENSER. EXTEND THRU ROOF
20. 1-1/4" RELIEF VALVE ON EVAPORATOR. EXTEND THRU ROOF.



1 FLOOR PLAN - HVAC

0 4' 8' 16'

SCALE: 1/8"=1'-0"

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FLOOR PLAN - HVAC

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PROJECT NO.: 052011

SHEET
M2.1

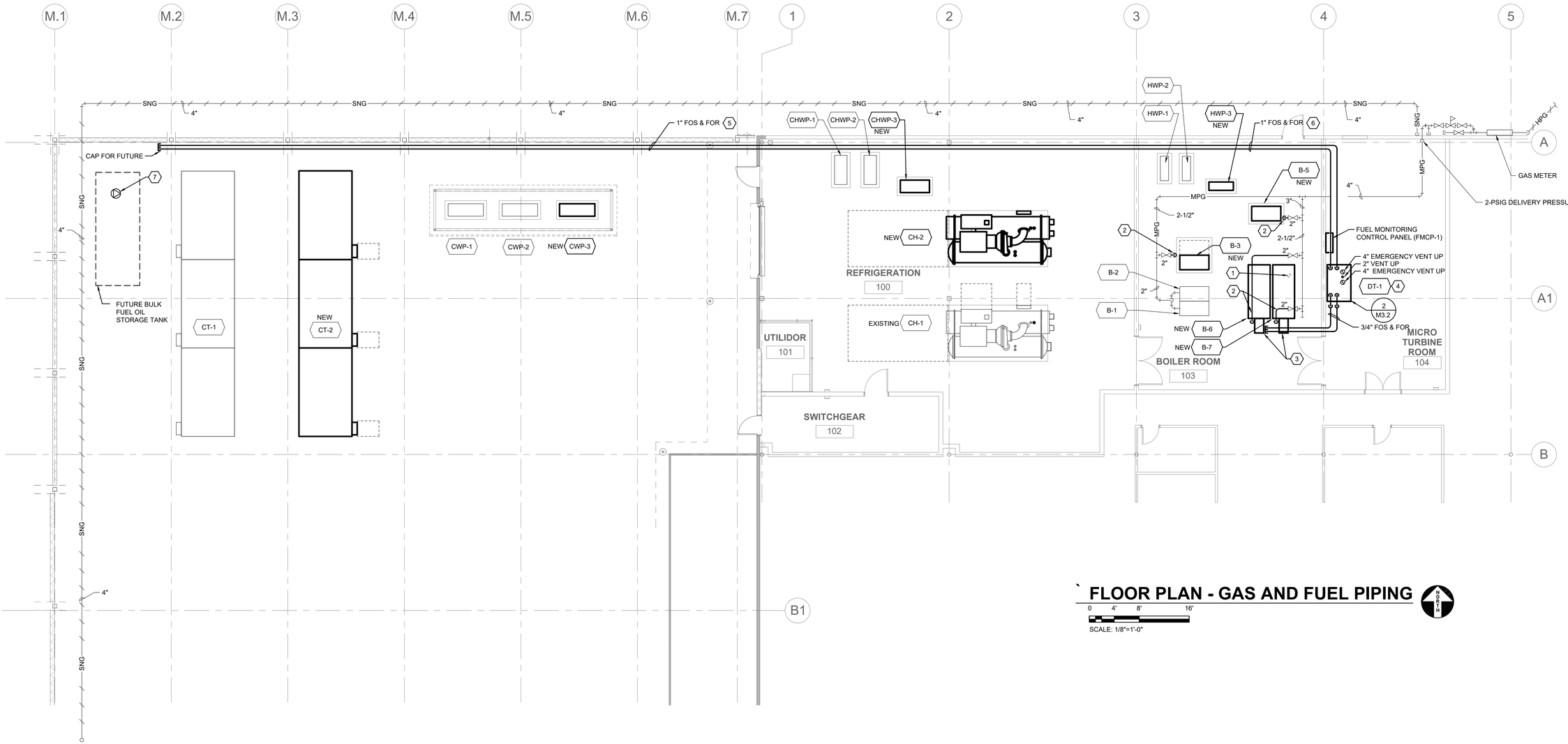
BID SET

GENERAL SHEET NOTES

A. ALL WALLS AND PARTITIONS IN REFRIGERATION, BOILER AND MICRO-TURBINE ROOM ARE FIRE RATED. ALL NEW PENETRATIONS TO MAINTAIN EXISTING RATINGS.

SHEET KEYNOTES

1. REMOVE AND CAP EXISTING FLOOR DRAIN UNDER NEW HOUSEKEEPING PAD.
2. NEW 2" GAS CONNECTION TO BOILER. PROVIDE VALVES, PIPING AND REGULATOR AS REQUIRED.
3. NEW 3/8" FUEL OIL SUPPLY AND RETURN CONNECTION TO BOILER BURNER. PROVIDE VALVING AND CONNECTIONS PER MANUFACTURERS INSTRUCTIONS.
4. NEW 200 GALLON FUEL OIL DAY TANK. PROVIDE WITH FLOAT LEVEL CONTROLS, HI/LOW LEVEL ALARMS AND LEAK DETECTION ALARMS
5. NEW 1" FUEL OIL SUPPLY AND RETURN PIPING. ROUTE PIPING THROUGH MECHANICAL YARD AND COORDINATE WITH EXISTING CONDITIONS. PIPING TO HANG ON EXISTING PIPING RACK WITH CONDENSER WATER PIPING TO LOCATION OF FUTURE FUEL OIL TANK.
6. NEW 1" FUEL OIL SUPPLY AND RETURN PIPING. ROUTE PIPING THROUGH MECHANICAL ROOMS AND COORDINATE WITH EXISTING CONDITIONS. FIRE SEAL ALL WALL PENETRATIONS TO MATCH EXISTING WALL RATINGS.
7. FUTURE SUBMERSIBLE PUMP (SP-1)



FLOOR PLAN - GAS AND FUEL PIPING

0 4' 8' 16'

SCALE: 1/8"=1'-0"

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FLOOR PLAN - GAS AND FUEL PIPING

ISSUE DATE: 05-23-2023
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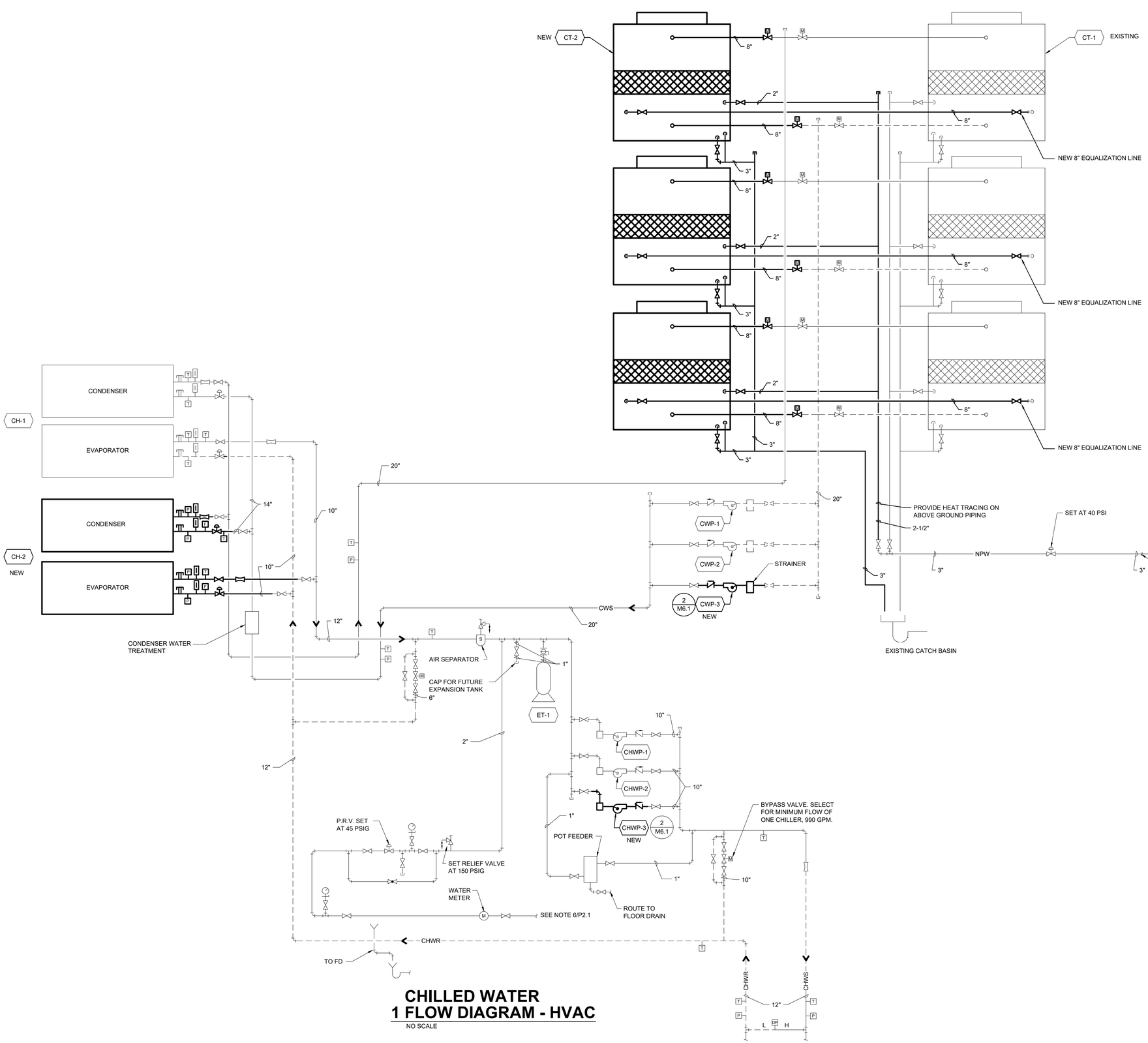
SHEET **M2.2**

BID SET



CHILLED WATER
1 FLOW DIAGRAM - HVAC

NO SCALE

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FLOW DIAGRAMS
- HVAC

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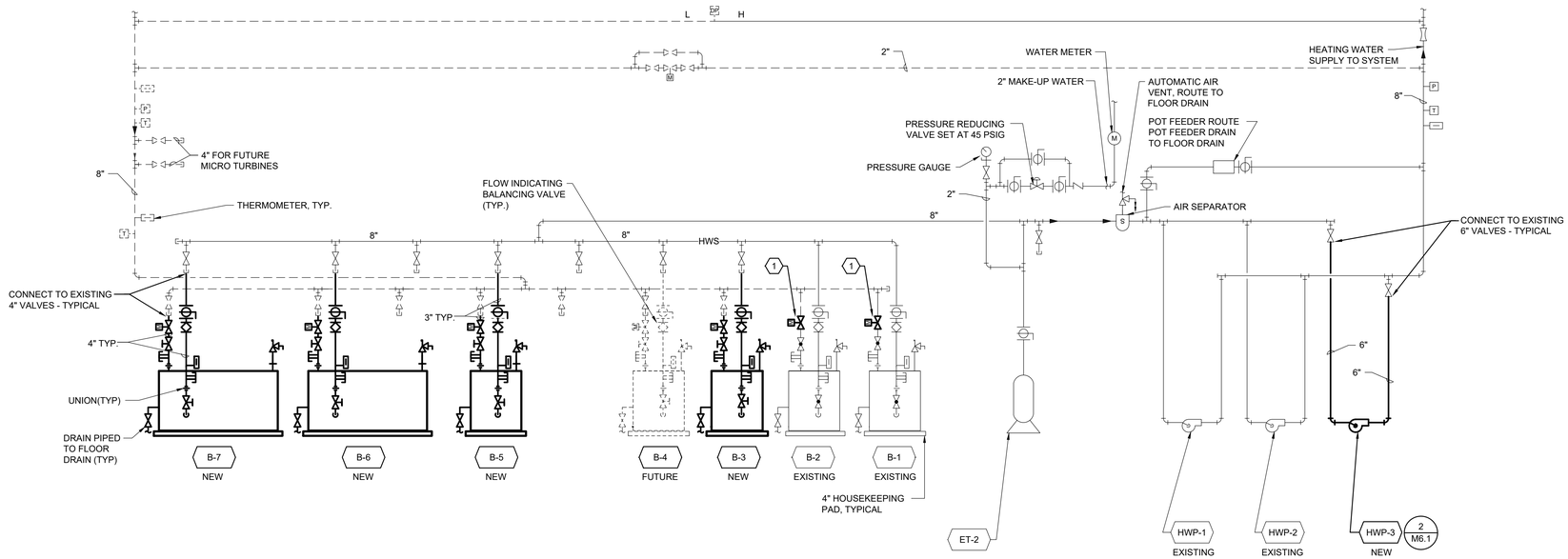
SHEET
M3.1

BID SET

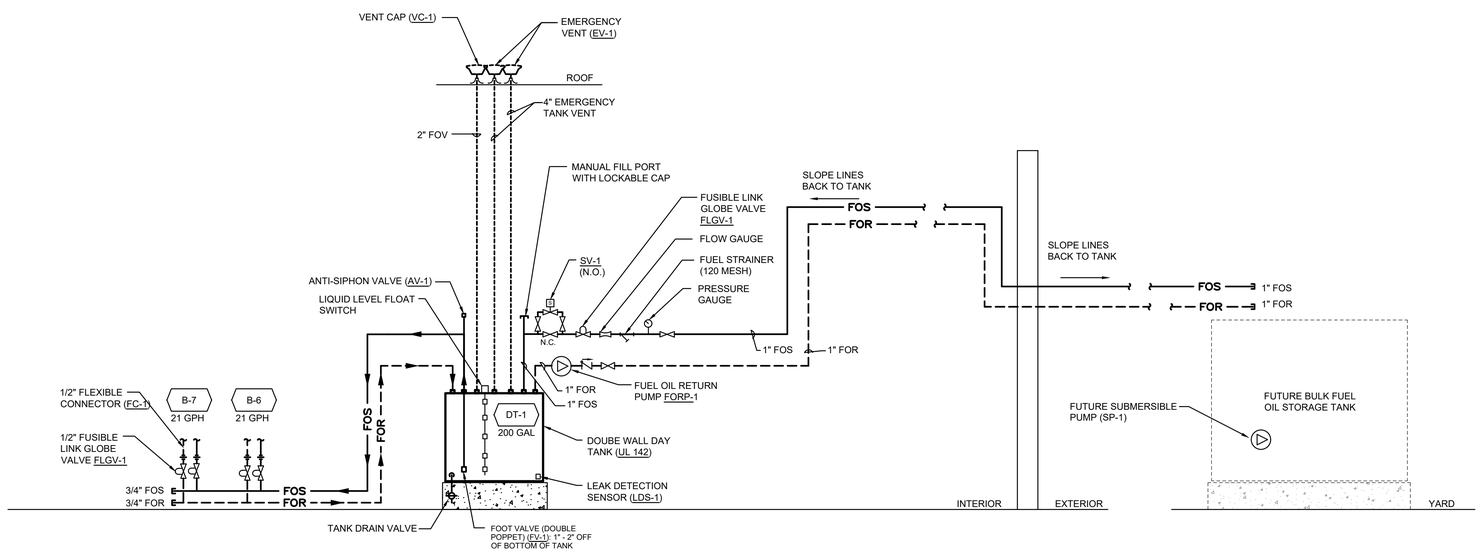
SHEET KEYNOTES

1 INSTALL NEW MOTORIZED VALVE AT EXISTING BOILERS.



HEATING WATER 1 FLOW DIAGRAM - HVAC

NO SCALE



FUEL OIL 2 PIPING DIAGRAM

NO SCALE

FUEL OIL SYSTEM CONTROL NOTES

DAY TANK SUPPLY SEQUENCE OF OPERATION

GENERAL:
THE SUBMERSIBLE PUMP CONTROL PANEL ALLOWS SELECTIONAL MODE FOR SUBMERSIBLE PUMPS SUPPLYING THE BOILER'S DAY TANK. THE SUBMERSIBLE PUMP CONTROL PANEL RECEIVES FUEL LEVEL AND LEAK INFORMATION FROM A FUEL MONITORING CONTROL PANEL FOR THE FUEL STORAGE TANK. WHEN ANY DAY TANK IS IN NEED OF FUEL, THE FUTURE SUBMERSIBLE PUMP CONTROL PANEL WILL START THE FUTRURE SUBMERSIBLE PUMP (SP-1) WITHIN THE FUTURE MAIN FUEL STORAGE TANK.

LOW FUEL LEVEL INDICATION:

1. THE BOILER'S FUEL PUMP WILL COME ON AND DRAW FUEL FROM THE DAY TANK WHEN REQUIRED.
2. WHEN THE FUEL LEVEL IN THE DAY TANK DROPS TO A PREDETERMINED LEVEL (50% FULL), THE FUTURE SUBMERSIBLE PUMP (SP-1) WILL COME ON THE FILL SOLENOID VALVE WILL OPEN, AND DELIVER FUEL TO THE DAY TANK.
3. AS THE BOILERS CONSUMES FUEL, THE DAY TANK WILL CYCLE THROUGH THE NORMAL OPERATING RANGE AS DETERMINED BY THE FUEL LEVEL SENSORS.
4. WHEN THE DAY TANK FUEL LEVELS REACH THE PROPER LEVEL (85%), THE FUTURE SUBMERSIBLE PUMP (SP-1) WILL SHUT DOWN.
5. THE NORMAL OPERATING RANGE IS FOR THE FILL VALVES (SV-1) PUMP TO ENERGIZE AT 50% AND DE-ENERGIZE AT 85%.
6. IF THE FUEL LEVEL CONTINUES TO RISE TO 90% IN THE DAY TANK, THE FLOAT SWITCH SHALL TURN ON THE FUEL OIL RETURN PUMP (FORP-1).
7. THE OVERFLOW RETURN LINE WILL ALLOW THE FUEL TO BE PUMPED BACK TO THE ABOVEGROUND STORAGE TANK VIA THE DAY TANK FUEL OIL RETURN PUMP (FORP-1).
8. IF THE FUEL LEVEL CONTINUES TO RISE TO 95% IN THE DAY TANK, THE FLOAT SWITCH SHALL ACTIVATE THE HIGH LEVEL OVERFLOW ALARM.
9. IF THE SUBMERSIBLE PUMP (SP-1) DOES NOT ENERGIZE AND ANY FUEL LEVEL DROPS TO A PRE-DETERMINED LEVEL (25% FULL), THE SENSOR SHALL SEND A LOW LEVEL ALARM SIGNAL TO THE FUEL MONITORING CONTROL PANEL.
10. PROVIDE A MANUAL SHUT-OFF BUTTON THAT WILL SHUT DOWN THE ENTIRE SYSTEM IN THE EVENT OF ACTIVATION.

L.E.D. READOUT	FUEL LEVEL
LOW LEVEL ALARM	25 PERCENT
SUBMERSIBLE PUMP ON	ANY SV-1 OPEN
NORMAL OPERATING RANGE	50-85 PERCENT
SV-1 CLOSE	85 PERCENT
FUEL OIL RETURN PUMP ON	ANY DAY TANK ABOVE 90 PERCENT
HIGH LEVEL OVERFLOW ALARM	ANY DAY TANK ABOVE 95 PERCENT

REMOTE ANNUNCIATION:
MODBUS RTU COMMUNICATION WITH THE BUILDING MANAGEMENT SYSTEM ALLOWS REMOTE ANNUNCIATION FOR THE FOLLOWING STATUS AND ALARM

CONDITIONS:

1. SUBMERSIBLE PUMP RUNNING	2. SUBMERSIBLE PUMP STOPPED
3. SUBMERSIBLE PUMP FAIL	4. SUBMERSIBLE PUMP NOT IN AUTO
5. STORAGE TANK LOW FUEL	6. DAY TANK CALL FOR FUEL
7. DAY TANK HIGH ALARM	8. DAY TANK LOW ALARM
9. DAY TANK CRITICAL LOW	10. DAY TANK LEAK ALARM

NORMAL CONDITIONS:
A POWER AVAILABLE INDICATOR LIGHT IS PROVIDED ON THE PANEL FRONT. SPECIFIC NORMAL OPERATING CONDITIONS ARE INDICATED ON THE TOUCH SCREEN DISPLAY. THE FOLLOWING NORMAL OPERATING CONDITIONS ARE PROVIDED:

1. SUBMERSIBLE PUMP RUNNING
2. SUBMERSIBLE PUMP RUN TIME METER
3. DAY TANK CALL FOR FUEL GENERATOR #1
4. DAY TANK CALL FOR FUEL GENERATOR #2
5. DAY TANK CALL FOR FUEL GENERATOR #3
6. DAY TANK CALL FOR FUEL BOILERS
7. MAIN TANK LEVEL (GALLONS)

STANDBY CONDITIONS:
STANDBY CONDITIONS ARE INDICATED ON TOUCH SCREEN DISPLAY. THE FOLLOWING STAND BY CONDITIONS ARE PROVIDED:

1. SUBMERSIBLE PUMP STOPPED

ALARM CONDITIONS:
SPECIFIC ALARM CONDITIONS ARE INDICATED ON THE TOUCH SCREEN. PUMP FAIL ALARMS WILL REMAIN LATCHED IN UNTIL RESET USING THE PUSHBUTTON ON THE TOUCH SCREEN. AN AUDIBLE ALARM AT THE CONTROL PANEL REMAINS ON UNTIL MANUALLY SILENCED. THE FOLLOWING ALARMS ARE PROVIDED:

1. STORAGE TANK LOW FUEL LEVEL
2. SUBMERSIBLE PUMP NOT IN AUTO
3. SUBMERSIBLE PUMP FAIL
4. ANALOG LEVEL TRANSDUCER FAILURE (1)

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CHILLER SCHEDULE

SYMBOL	AREA SERVED	TYPE	MODEL	CAPACITY (TONS)	EVAPORATOR MAXIMUM PRESSURE DROP (FT)	EVAPORATOR FLOW (GPM)	EVAPORATOR EWT (F)	EVAPORATOR LWT (F)	EVAPORATOR FOULING FACTOR (FT2 F HR/BTU)	CONDENSER MAXIMUM PRESSURE DROP (FT)	CONDENSER FLOW (GPM)	CONDENSER EWT (F)	CONDENSER LWT (F)	CONDENSER FOULING FACTOR (FT2 F HR/BTU)	MAXIMUM NPLV (KW/TON)	MAXIMUM FULL LOAD (KW/TON)	MAX. OPERATING WT. (LBS)	ELECTRICAL VOLT/PH	ELECTRICAL FLA	ELECTRICAL MCA	ELECTRICAL MOCP	REMARKS
CH-1 (EXISTING)	CENTRAL UTILITY PLANT	CENTRIFUGAL	YORK	1000	12	1,150	59.0	38.0	0.00010	9	2,740	75.0	85.0	0.00025	0.449	0.542	44,902	460/3	750	952	1600	
CH-2 (NEW)	CENTRAL UTILITY PLANT	CENTRIFUGAL	YORK - YMC2	960	6.2	1,150	58.0	38.0	0.00010	10.4	2,740	75.0	85.0	0.00025	0.374	0.550	32,938	460/3	691	864	1200	1, 2, 3, 4

1. OWNER FURNISHED, CONTRACTOR INSTALLED.
2. R-134A REFRIGERANT.
3. UNIT-MOUNTED COMPRESSOR MOTOR VARIABLE FREQUENCY DRIVE PROVIDED BY CHILLER MANUFACTURER.
4. UNIT-MOUNTED FUSED DISCONNECT PROVIDED BY CHILLER MANUFACTURER.

FUEL HANDLING EQUIPMENT SCHEDULE

SYMBOL	EQUIPMENT TYPE	LOCATION / SERVING	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	ELECTRICAL VOLTS	ELECTRICAL PH	ELECTRICAL AMPS	ELECTRICAL WATTS	ELECTRICAL HP	ACCESSORIES / NOTES
AV-1	ANTI-SIPHON VALVE	MICRO TURBINE ROOM 104/DAY TANK	OPW	199ASV	---	---	---	---	---	ALUMINUM BODY, 3/4"
DT-1	DAY TANK	MICRO TURBINE ROOM 104/BOILERS	SIMPLEX	STS200-FR	---	---	---	---	---	DOUBLE WALLED W/ LEAK DETECTION. UL 142 FIRE RATED DAY TANK. SUPPLY FIRE-RATED BALL VALVE FOR PRIMARY TANK DRAIN, SECONDARY TANK DRAIN, SUPPLY TO TANK FROM AST. PROVIDE SIMPLEX FUEL RETURN PUMP (25 GPM). PROVIDE FIRE-RATED, SELF CLOSING FUSIBLE LINK GLOBE VALVE (FLGV-1) ON SUPPLY TO DAY TANK.
EV-1	EMERGENCY VENT	MICRO TURBINE ROOM 104/DAY TANK	OPW	244F & 244OF	---	---	---	---	---	VENT SIZE: 4"
FC-1	FLEXIBLE CONNECTOR	BOILER ROOM 103/BOILERS	UNISOURCE	STYLE MMS	---	---	---	---	---	
FLGV-1	FUSIBLE LINK GLOBE VALVE	MICRO TURBINE ROOM 104/DAY TANK	MORRISON BROTHERS	FIG. 939	---	---	---	---	---	
FMCP-1	FUEL MONITORING CONTROL PANEL	MICRO TURBINE ROOM 104/FUEL HANDLING SYSTEM	VEEDER-ROOT	TLS-350	120 V	1	2	---	---	INTERNAL HARDWARE OPTIONS: FMP-LCD (COLOR LCD TOUCH SCREEN) WITH EXTERNAL PRINTER (FMP-ETP) AND THERMAL PRINTER PAPER ROLLS (FMP-EPPC).
FORP-1	FUEL OIL RETURN PUMP	MICRO TURBINE ROOM 104/DAY TANK	SIMPLEX	425	208 V	1	---	---	1.5	25 GPM WITH LIP SEAL. PROVIDE SIMPLEX 1045 MOTOR.
FV-1	FOOT VALVE	MICRO TURBINE ROOM 104/DAY TANK	OPW	92-0033	---	---	---	---	---	3/4"
LDS-1	LEAK DETECTION SENSOR	MICRO TURBINE ROOM 104/DAY TANK	VEEDER-ROOT	847990-001	---	---	---	---	---	UNIVERSAL LIQUID SENSOR (NON-DISCRIMINATING)
SV-1	SOLENOID VALVE	MICRO TURBINE ROOM 104/DAY TANK	ASCO REDHAT	8210G095	120 V	1	---	---	---	NORMALLY CLOSED.
VC-1	VENT CAP (ATMOSPHERIC)	MICRO TURBINE ROOM 104/DAY TANK	MORRISON BROTHERS	354	---	---	---	---	---	2" DIAMETER CONNECTION WITH ANODIZED ALUMINUM BODY AND HOOD. RATED FOR DIESEL FUEL.

COOLING TOWER SCHEDULE

SYMBOL	AREA SERVED	COND. WTR. FLOW (GPM)	ELEV. RISE (FT)	INLET PRES. DROP (PSI)	EWT (F)	LWT (F)	E.W.B. (F)	TOTAL FAN AIRFLOW (CFM)	FAN MOTOR QTY	FAN MOTOR (HP)	SUMP HEATER QTY	SUMP HEATER (KW)	EVAPORATON RATE (GPM)	MANUF. AND MODEL	MAX. OPER. WT. (LBS)	ELEC. VOLT/PH	REMARKS
CT-1 (EXISTING)	CENTRAL UTILITY PLANT	2,740	10	0.5	85.0	75.0	68.0	237,400	3	25	6	5	22	EVAPCO AT 39-742	32,520	480/3 (X9)	
CT-2 (NEW)	CENTRAL UTILITY PLANT	2,740	10	0.5	85.0	75.0	68.0	255,700	3	30	6	5	22	EVAPCO AT 39-3M42	32,760	480/3	1, 2, 3

1. OWNER FURNISHED, CONTRACTOR INSTALLED.
2. EACH FAN AND SUMP HEATER REQUIRES A SEPARATE 480V/3Ø CONNECTION. TOTAL OF 9 ELECTRICAL CONNECTIONS PER UNIT.
3. PROVIDE VARIABLE FREQUENCY DRIVE ON EACH FAN MOTOR. TOTAL OF 3 VARIABLE FREQUENCY DRIVES PER UNIT.

PUMP SCHEDULE

SYMBOL	SERVING	TYPE	FLOW RATE (GPM)	HEAD (FT.H2O)	MAX REQD. NPSH (FT.H2O)	RPM	MIN EFF. (%)	ELECTRICAL VOLT/PH	ELECTRICAL HP	MANUF. AND MODEL	MAX WT. (LBS)	REMARKS
CHWP-1 (EXISTING)	CHILLED WATER	END SUCTION	1,150	160	10	1,750	80	460/3	60	B&G 1510-5G	1500	2
CHWP-2 (EXISTING)	CHILLED WATER	END SUCTION	1,150	160	10	1,750	80	460/3	60	B&G 1510-5G	1500	2
CHWP-3 (NEW)	CHILLED WATER	END SUCTION	1,150	160	9	1,750	85	460/3	60	TACO 5013D	1698	1, 2
CWP-1 (EXISTING)	CONDENSER WATER	VERT. SPLIT CASE	2,740	50	8	1,150	79	460/3	50	B&G 10x12x13.5 VSCS	3000	2
CWP-2 (EXISTING)	CONDENSER WATER	VERT. SPLIT CASE	2,740	50	8	1,150	79	460/3	50	B&G 10x12x13.5 VSCS	3000	2
CWP-3 (NEW)	CONDENSER WATER	VERT. SPLIT CASE	2,740	50	11	1,150	75	460/3	50	TACO 100813	3385	1, 2
HWP-1 (EXISTING)	HEATING WATER	END SUCTION	370	130	5	1,750	72	460/3	20	B&G 1510-3G	680	2
HWP-2 (EXISTING)	HEATING WATER	END SUCTION	370	130	5	1,750	72	460/3	20	B&G 1510-3G	680	2
HWP-3 (NEW)	HEATING WATER	END SUCTION	370	130	7	1,750	72	460/3	20	TACO 3013D	860	1, 2

1. OWNER FURNISHED, CONTRACTOR INSTALLED.
2. VARIABLE FREQUENCY DRIVE.

BOILER SCHEDULE

SYMBOL	MAX. GROSS INPUT (MBH)	MIN. GROSS OUTPUT (MBH)	MIN. EFF.	FLUE SIZE (IN.)	ENTER WATER TEMP. (°F)	LEAVING WATER TEMP. (°F)	DESIGN FLOW (GPM)	MIN. FLOW (GPM)	MANUF. AND MODEL	APPROX. WEIGHT (LB.)	ELECTRICAL VOLT/PH	ELECTRICAL MCA	ELECTRICAL MOCP	REMARKS
B-1 (EXISTING)	2,000	1,720	90	8	120	160	88	25	AERCO BENCHMARK	1785	460/3	15	20	
B-2 (EXISTING)	2,000	1,720	90	8	120	160	88	25	AERCO BENCHMARK	1785	460/3	15	20	
B-3 (NEW)	2,000	1,720	90	8	120	160	88	25	AERCO BENCHMARK	1785	460/3	15	20	1
B-4 (FUTURE)	2,000	1,720	90	8	120	160	88	25	AERCO BENCHMARK	1785	460/3	15	20	3
B-5 (NEW)	2,000	1,720	90	8	120	160	88	25	AERCO BENCHMARK	1785	460/3	15	20	1
B-6 (NEW)	3,000	2,820	94	14	120	160	132	25	RIELLO RTC-80 3000	7385	460/3	15	20	1, 2
B-7 (NEW)	3,000	2,820	94	14	120	160	132	25	RIELLO RTC-80 3000	7385	460/3	15	20	1, 2

1. OWNER FURNISHED, CONTRACTOR INSTALLED.
2. DUAL FUEL BOILER - NATURAL GAS/FUEL OIL
3. FUTURE BOILER

INTERFACE ENGINEERING
PROJECT 2022-1549
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REGISTERED PROFESSIONAL ENGINEER
17430PE
OREGON
SEPT. 28, 1976
ANDREW W. FRICHTL
EXPIRES:12/31/23

CENTRAL UTILITY PLANT

CLACKAMAS COUNTY
Red Soils Campus, Oregon City

CLACKAMAS COUNTY

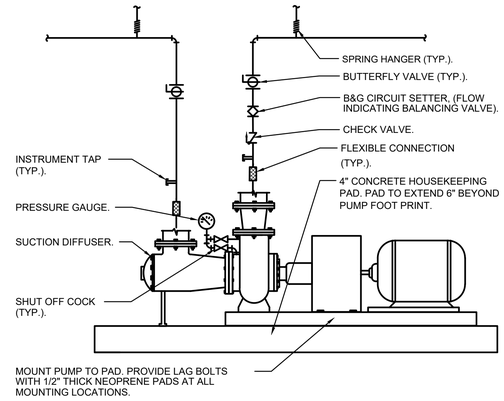
REVISIONS

SCHEDULES - HVAC

ISSUE DATE: 05-23-2023
PROJECT NO.: 052011

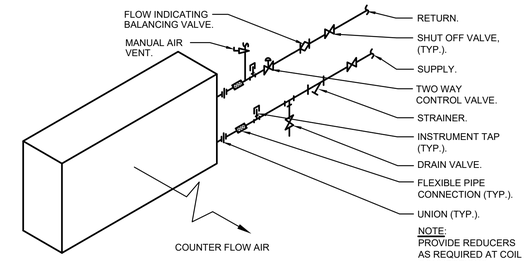
SHEET
M4.1

BID SET



1 BASE MOUNTED PUMP

NO SCALE MHOEQ02A.dwg



2 UNIT HEATER COIL 2-WAY VALVE

NO SCALE

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REVISIONS

DETAILS - MECHANICAL

ISSUE DATE: 05-23-2023
PROJECT NO.: 052011

SHEET
M6.1

BID SET